Office of the Prime Minister's Chief Science Advisor
Kaitohutohu Mātanga Pūtaiao Matua ki te Pirimia

# The Future is Open

Establishing Wider Open Access for Research Publications in Aotearoa New Zealand

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Thomas E. Saunders

Intern, Office of the Prime Minister's Chief Science Advisor | Kaitohutohu Mātanga Pūtaiao Matua ki te Pirimia

# Foreword

One of the most enjoyable aspects of my role is hosting interns from all over Aotearoa who are passionate about working on issues at the research-policy interface. Tom Saunders was with us in 2021, after finishing his PhD, and delved into the complexities of Open Access publishing.

The rationale for opening up academic research is simple: we can all agree at a high level that publicly-funded research should be available to the public. Apart from the simple transparency argument, this is becoming increasingly important in the era of misinformation – the internet allows anyone to do their own research, but paywalls present a huge barrier to accessing peer-reviewed and accurate information, in a world where conspiracy theories are free.

The simplicity ends here though. The reality of unpicking the complexities of the current publishing models is complicated and full of nuance, grounded as they are in the days of hardcopy print, increasingly driven by profit, and entangled in the wider context of academic performance and impact evaluation.

Tom has done an excellent job of diving into the details, interrogating international solutions, and consulting widely across the sector and with stakeholders. I commend his report and recommendations to you and hope they move us further along the path to a future that is indeed open.

Juliet Gerrard

## Executive summary

This report offers recommendations for Aotearoa New Zealand's public research funders to improve access to publicly funded research. It is the result of a three-month science policy internship in the office of Professor Dame Juliet Gerrard, the Prime Minister's Chief Science Advisor, commencing in June 2021. These recommendations, and the accompanying background material, are informed by a review of literature, and consultations with domestic and international stakeholders including research funders, scholarly communication and library professionals, research institutions, and individual researchers.

THE NEW ZEALAND GOVERNMENT INVESTS AROUND $1.7B ANNUALLY INTO RESEARCH AND IS COMMITTED TO MAKING THE RESULTS OF THIS INVESTMENT MORE RELEVANT AND ACCESSIBLE TO END-USERS

The New Zealand Government invests around $1.7b annually into research and is committed to making the results of this investment more relevant and accessible to end-users. Much of the output of this research is published in electronic scholarly journals behind digital paywalls, and cannot be accessed without a subscription. Much of it is therefore not available to the general public. If Aotearoa New Zealand is to pursue the goals of Open Research, which emphasise the importance of transparency, accountability, reproducibility, accessibility, and collaboration in how scholarly research is designed, conducted, disseminated, and evaluated, we need to improve access to scholarly publications. A key pillar of Open Research is Open Access (OA), the practise of making research literature freely available on the internet where this is ethically and culturally appropriate, under terms which allow most kinds of reuse, while ensuring authors are properly acknowledged. OA benefits the research process by providing access to current scholarly knowledge. It benefits researchers by providing a greater readership and citation rate for their work. And importantly, it benefits society by allowing the public to access high quality peer reviewed research, improving their understanding of the world around them and combating misinformation.

The recommendations in this report are designed to lay the foundations for a long-term OA strategy in Aotearoa New Zealand. Some recommendations will take longer than others to implement, and some may require more investment to achieve. The magnitude of necessary investment will become clearer as consultation progresses. Implementing the full set of recommendations will of course depend on the availability of resources, but we need to be aware of the costs of inaction. Allowing our research to remain locked behind paywalls robs us of the opportunity to extract maximum impact and value from each dollar of public money invested. It slows the pace of scientific discovery, research commercialisation, and the development of evidence-based public policy. And it prioritises the interests of offshore publishing companies above the people who fund, conduct, and contribute to the research in the first place.

ALLOWING OUR RESEARCH TO REMAIN LOCKED BEHIND PAYWALLS ROBS US OF THE OPPORTUNITY TO EXTRACT MAXIMUM IMPACT AND VALUE FROM EACH DOLLAR OF PUBLIC MONEY INVESTED

The future is Open.

## Summary of recommendations

**1. Assemble a steering group to guide future work**

A steering group should be assembled to coordinate the development and implementation of a national strategy for open research. Members should be drawn from key organisations and meet semi-regularly to discuss progress. The group should include Māori representation and have representatives from funders, policy makers, librarians, and research practitioners.

Membership could include:

- Ngā Pae o te Māramatanga
- Ministry of Business, Innovation and Employment
- The Royal Society of New Zealand | Te Apārangi
- Health Research Council
- Universities New Zealand Deputy Vice Chancellors Research Committee
- Council of New Zealand University Librarians (CONZUL)
- National Library of New Zealand
- Crown Research Institute Librarians
- Open Access Australasia
- Office of the Prime Minister's Chief Science Advisor

The steering group would meet at regular intervals to discuss progress towards developing and implementing a national strategy for open research. The steering group would help to coordinate efforts between all key stakeholders within and outside of the research sector.

**2. Consult widely in partnership with Māori**

The New Zealand government has important constitutional responsibilities to act in partnership with Māori under Te Tiriti o Waitangi. Accordingly, for any research policy to be relevant in Aotearoa New Zealand it must be relevant and accessible to Māori. Broad and deep consultation will be required to understand the needs and concerns of the many stakeholders within the research sector. Consultation with the wider research sector, funders, public sector, and other key end-users will ensure any resulting mandate is fit-for-purpose. .

FOR ANY RESEARCH POLICY TO BE RELEVANT IN AOTEAROA NEW ZEALAND IT MUST BE RELEVANT AND ACCESSIBLE TO MĀORI

**3. Undertake a review of academic publishing in Aotearoa**

A comprehensive review of academic publishing in Aotearoa New Zealand is essential to understand how our researchers publish their work, why they make the choices they do, the potential long-term effects of their decisions, and how publishing behaviour and outcomes vary between disciplines. This review would be undertaken in partnership with Māori stakeholders and include: an inventory of local OA publishing options, an assessment of current infrastructure, a nationwide estimate of current expenditure on toll-access and open access publishing, and a review of current staffing and resource allocations to the scholarly communications and research support teams in our research institutions. It will also be important to understand the needs of our independent researchers and smaller research organisations.

**4. Set out a roadmap for Open Research in Aotearoa New Zealand**

A roadmap for Open Research would offer a high-level national plan for lifting research standards across the country and promoting best practices developed around the world. It would be informed by consultation in recommendation one and outline where we are currently, where we want to get to, and it would outline specific milestones and goals along the path to achieving these desired outcomes. It will be important for a roadmap to align with existing initiatives within Aotearoa's changing RSI sector, such as MBIE's Draft RSI Strategy, Te Ara Paerangi, and changing understanding of research excellence and impact which recognise the unique contributions made by Mātauranga Māori.

**5. Endorse the principles of Open Research**

The New Zealand Government should consider aligning with international initiatives promoting open research practices. More specifically, it should consider adopting the UNESCO Recommendation on Open Science following the ratification of the text at the UNESCO General Conference in November 2021. At the same time, it should consider joining thousands of other governments, major research funding bodies, and other scholarly organisations in signing important statements on research evaluation and practise. These include the San Francisco Declaration on Research Assessment (DORA) and the Leiden Manifesto for Research Metrics.

**6. Consider appropriate options for an OA mandate**

This report identifies three major options for shaping an OA mandate in Aotearoa New Zealand. These options are not mutually exclusive and components of each could be pursued simultaneously. They include:

1. Consider joining cOAlition S at a national level. This is a group of major public and NGO research funders based mainly in Europe and North America. They intend to implement Plan S, a set of principles requiring recipients of grants to publish in OA journals or to upload their accepted manuscripts to an open repository immediately on publication. Membership in the coalition would entail benefits, risks, and challenges.

2. Consider negotiating a country-level 'read and publish' agreement with major publishers to repurpose existing expenditure towards OA. This would likely result in caps on the number of articles able to be published before regular APCs are charged. This type of plan is currently being considered in Australia under the auspices of Dr Cathy Foley, Australia's Chief Scientist. There are a number of important considerations that come with such a plan, and the feasibility of such a strategy in Aotearoa New Zealand is currently unclear.

3. Consider institutional-level rights retention strategies which would allow the organisations employing researchers to make available a copy of all accepted manuscripts in their institutional repositories (or other appropriate venues) immediately upon publication. This strategy has been adopted by several influential institutions overseas, such as Harvard University, where the policy was voted in unanimously by faculty. It represents a reasonable compromise between the interests of publishers, institutions, funders, and researchers, and doesn't require the development of new business models or significant financial outlays, as compared with other options.

**7. Promote coordination with domestic and regional partners**

We have a skilled community of scholarly communication professionals in our university libraries, research institutes, and non-governmental organisations. It will be essential to draw on their experience to design an effective mandate that serves all of those with a stake in New Zealand research, and to lay the foundations for a robust OA strategy more broadly. Coordination between New Zealand and Australia on Open Research policy would serve both countries well in the long term.

**8. Assess resourcing needs for implementation of a mandate**

Consultation will need to include an analysis of resourcing needs to support implementation of the OA mandate. New Zealand research institutions may need to be supported to implement a mandate effectively. Libraries and their staff will be at the center of this work so will need to be resourced accordingly. This would require targeted funding for university and CRI libraries so they could reverse recent budget cuts to attract and retain qualified staff. Changes in publishing practice will need to be appropriately shared with researchers. This is likely to require training to help researchers understand more about the publishing process, what the mandate is asking of them, why they are being asked to make their work OA, and how they can comply with the mandate.

**9. Adopt a largely automated process to spot-check compliance**

Funders have emphasized the importance of having an efficient compliance checking process. High level compliance checking can be carried out by aggregating data from digital services such as Unpaywall and Crossref to ascertain whether or not an open version of each in-scope paper is available. The Council of New Zealand University Librarians (CONZUL) has offered to monitor compliance with the tools they have developed and are willing to report results and offer advice to a central funder, for example Te Apārangi |The Royal Society or directly to MBIE. Funders would then be responsible for following up with institutions or unaffiliated researchers.

**10. Stay abreast of international developments**

There is a risk that Aotearoa New Zealand may fall out of step with OA strategies and policies being pursued by a diverse range of funders, universities, and NGOs around the world, but particularly in Europe and North America. We should monitor international developments in OA and publishing to ensure our approach remains compatible with those pursued by countries with which we share research links.

# Table of Contents

# 1 Introduction: The research system in Aotearoa New Zealand

The New Zealand Government invests around $1.7 billion into research annually. Aotearoa New Zealand's science system is relatively small and we spent only 1.41% of GDP on research and development in 2019, which is about half the OECD average. However, our researchers are remarkably productive and well-respected, achieving almost three times the publication output per $1 million dollars invested in research compared with the OECD average, and producing over twice the average number of publications per year per researcher.[1] In addition, our research publications are in the top 1% most-cited, at a rate 35% higher than the OECD average. Publicly funded research activity is concentrated within our eight universities, seven Crown Research Institutes (CRIs), and Te Pūkenga - New Zealand Institute of Skills and Technology (the national vocational training provider formed by the merger of Aotearoa New Zealand's 16 institutes of technology and polytechnics). Our research organisations are recognised internationally for the excellent research they produce, and the quality of graduates, faculty, and staff they train and employ.[2] New Zealand's universities employ the majority of our full-time equivalent research staff and generate $600-700 million per year through commercialisation of research.[3] Around 40% of university incomes are derived from direct government funding, while 30% comes from student tuition fees, and the remaining 30% from commercialisation and trading revenue. All our universities are ranked within the top 500 in the world.

WE SPENT ONLY 1.41% OF GDP ON RESEARCH AND DEVELOPMENT IN 2019, WHICH IS ABOUT HALF THE OECD AVERAGE

Our CRIs were formed in 1992 following the break-up of the Department of Scientific and Industrial Research into Crown-owned companies.[4] Each CRI has a statement of core purpose which outlines the area of applied research it specialises in. CRIs are subject to the Crown Research Institutes Act 1992 and the Companies Act. They are required to be financially sustainable and are expected to pay a dividend to the government (although the government can choose to waive this obligation). A recent review[5] recommended significant changes to the way CRIs operate, including a shift in emphasis from contestable to stable core funding, encouraging more collaboration and genuine partnerships, and removing CRIs from being subject to the Companies Act. A recent high-level review[6] of the Aotearoa New Zealand science system by Science New Zealand emphasised the importance of unimpeded information flow between research organisations and the wider pool of end-users, including businesses.

[1] New Zealand CRIs, 'Pathways to the Future: Strategy to Lift the Positive Impact of Science on Aotearoa New Zealand's Economy, Environment, Society and Cultures' (Wellington, NZ: Science New Zealand, 1 September 2021), https://scientists.org.nz/resources/Documents/PressReleases/Pathways_to_the_Future_01-09-21.pdf.
[2] J. M. Crow, 'Why New Zealand Is an Attractive Destination for Scientists', *Nature* 561, no. 7721 (4 September 2018): 141–42, https://doi.org/10.1038/d41586-018-06171-0.
[3] Universities New Zealand, 'How NZ Universities Are Funded', 2017, https://www.universitiesnz.ac.nz/about-university-sector/how-nz-universities-are-funded.
[4] Anonymous, 'Review of Crown Research Institute Core Funding' (Wellington, NZ: New Zealand Ministry of Business, Innovation, and Employment, 2016), https://www.mbie.govt.nz/assets/e0b3af622e/cri-core-funding-review.pdf.
[5] D. Smol et al., 'Te Pae Kahurangi: Positioning Crown Research Institutes to Collectively and Respectively Meet New Zealand's Current and Future Needs' (Wellington, NZ: Ministry of Business, Innovation, and Employment, 2020), https://www.mbie.govt.nz/assets/te-pae-kahurangi-report.pdf.
[6] New Zealand CRIs, 'Pathways to the Future: Strategy to Lift the Positive Impact of Science on Aotearoa New Zealand's Economy, Environment, Society and Cultures'.

The Government has recently outlined several priorities for improving the research, science, and innovation system. Impact sits at the heart of these priorities,[7] and they include: supporting researchers to make their work more relevant and accessible to end-users; enhancing connections and collaborations between researchers, businesses, and the public sector; and demonstrating the value and impact of publicly funded research to the public. To realise these goals the Government has committed to lifting research and development spending to 2% of GDP by 2027. The science funding landscape in Aotearoa New Zealand is dominated by the Ministry of Business, Innovation and Employment (MBIE), which provides around two thirds of government investment in research, largely spread between its own Endeavour Fund and Strategic Science Investment Fund, and smaller funds administered by independent statutory entities.[8]

THE GOVERNMENT HAS COMMITTED TO LIFTING RESEARCH AND DEVELOPMENT SPENDING TO 2% OF GDP BY 2027

The Royal Society of New Zealand Te Apārangi represents scientific, technical, and humanities organisations, promotes the advancement of scholarly inquiry, provides expert advice to Government on important public issues, and administers several important government research funds from MBIE. The most prestigious of these funds is the Marsden Fund, a contestable fund which awards grants for blue skies investigator-led research out of a pool of $80 million per year.[9] The Royal Society Te Apārangi also administers the Catalyst Fund (around $10 million per year), and awards Rutherford Discovery Fellowships and the one-off MBIE Science Whitinga Fellowships. Medical and health research funding is administered by the Health Research Council (HRC), who distribute around $125 million per year, mostly through investigator-led project-based research contracts.[10] Besides MBIE, the Tertiary Education Commission (TEC) administers the Performance-Based Research Fund (PBRF) which awards funding to tertiary education organisations based on the quality of their research output, their number of degree completions, and the amount of external research funding they bring in.[11] The PBRF is broadly similar to the UK REF administered by Research England.

[7] Anonymous, 'The Impact of Research: Position Paper' (Wellington, NZ: Ministry of Business, Innovation, and Employment, October 2019), https://www.mbie.govt.nz/dmsdocument/6983-the-impact-of-research-position-paper-october-2019-pdf.

[8] Anonymous, 'Draft Research, Science and Innovation Strategy' (Wellington, NZ: Ministry for Business, Innovation, and Employment, September 2019), https://www.mbie.govt.nz/dmsdocument/6935-new-zealands-research-science-and-innovation-strategy-draft-for-consultation.

[9] Marsden Fund Council, 'Mahere Haumi o Te Pūtea Rangahau a Marsden: Marsden Fund Investment Plan 2021–2024' (Wellington, NZ: Royal Society of New Zealand, May 2021), https://www.royalsociety.org.nz/assets/Uploads/Marsden-Fund-Investment-Plan.pdf.

[10] Anonymous, 'HRC Investment Plan 2021-2023' (Wellington, NZ: Health Research Council of New Zealand, 2020), https://www.hrc.govt.nz/sites/default/files/2021-04/HRC%20Investment%20Plan%202021-2023.pdf.

[11] Anonymous, 'Performance-Based Research Fund', Tertiary Education Commission, 19 September 2016, https://www.tec.govt.nz/funding/funding-and-performance/funding/fund-finder/performance-based-research-fund/; Anonymous, 'Performance-Based Research Fund Review: Discussion Document' (Wellington, NZ: Ministry of Education, October 2020), https://www.education.govt.nz/assets/Documents/Further-education/PBRF-Review/PBRF-Review-Discussion-Document.pdf.

It is timely to consider a national Open Access mandate for Aotearoa New Zealand and to reflect on the long-term sustainability of academic publishing here and around the world. The publishing landscape is complex and rapidly changing. Recent announcements from international research and funding bodies have signalled strong commitments to transition towards OA for publicly funded research. Funders have been encouraging more openness and transparency for some time now, and an increasing number are enacting their own OA mandates. Many public bodies are recognising how open access to research publications aligns with their values of transparency, impact, and excellence, and their missions to improve knowledge linkages between different sectors of society. Established commercial publishers are wary of how mandates may affect their bottom lines, but many large publishers have been successful in turning OA publication into additional revenue streams.

MANY PUBLIC BODIES ARE RECOGNISING HOW OPEN ACCESS TO RESEARCH PUBLICATIONS ALIGNS WITH THEIR VALUES OF TRANSPARENCY, IMPACT, AND EXCELLENCE, AND THEIR MISSIONS TO IMPROVE KNOWLEDGE LINKAGES BETWEEN DIFFERENT SECTORS OF SOCIETY

The recent COVID-19 pandemic has reinforced the importance of open research, not just to improving the efficiency of the research process, but for translating new findings into effective (and often life-saving) public policy.

## 2 Scholary publishing: the rise of the paywall

Prior to the Second World War, most academic journals were published by scholarly societies. The shift towards the commercialisation of research, and the modes of its dissemination, accelerated through the 1950s as one theme in the wider transformation of the scientific enterprise.[12] Against the backdrop of changing business models and increasing international collaboration, learned societies were questioning whether the entrepreneurial motives of commercial publishers would end up serving the research process.[13] The Nuffield Foundation commissioned a project led by senior figures from The Royal Society of London to support learned societies whose revenues were dwindling due to post-war austerity in the UK.[14] Societies were initially recommended to streamline their processes and cut corners (literally to reduce the size of their pages) to save money, but ultimately, the Nuffield project recommended societies capitulate to the offers of commercial publishers to take over their publishing operations, or to adopt commercial models for themselves.

[12] A. Fyfe, 'Self-Help for Learned Journals: Scientific Societies and the Commerce of Publishing in the 1950s', *History of Science*, 18 March 2021, 1–25, https://doi.org/10.1177/0073275321999901.
[13] A. V. S. De Reuck, 'Learned Societies as Publishers', *Nature* 197, no. 4866 (1 February 1963): 426–27, https://doi.org/10.1038/197426a0; D. C. Martin, 'The Royal Society's Interest in Scientific Publications and the Dissemination of Information', *Aslib Proceedings* 9, no. 5 (1 January 1957): 127–41, https://doi.org/10.1108/eb049627.
[14] F. Morley, *Self-Help for Learned Journals. Notes Compiled for the Nuffield Foundation* (Oxford, UK: Oxford University Press, 1963), http://archive.org/details/selfhelpforlearn0000morl.

## 1. Glossary of Publishing Terms

**Open Access (OA)**: Open access literature is digital, online, free of charge, and free of most copyright and licensing restrictions.

**Gold OA:** OA provided by journals, regardless of the journals business model.

> *APC-based journals*: Gold journals which charge a publication fee (Article Processing Charge).
>
> *Diamond journals*: Gold journals which do not charge a publication fee.

**Green OA**: OA provided by repositories. In practise, this involves the deposit of the Accepted Manuscript, usually after a 6-12 month (publisher-imposed) embargo period, from the date of publication in a journal.

> *Accepted Manuscript*: The final version of a peer-reviewed manuscript before the publisher has typeset and formatted the document.
>
> *OA repository*: An online database of OA works. Institutional repositories host outputs from an institution, while disciplinary repositories host outputs from a whole field.

**Bronze OA**: Outputs available on the publisher's website at their discretion and without a license clearly articulating reuse rights.

**Toll-access**: The publishing of content behind a paywall. Access is provided only to individuals or institutions who pay a subscription fee to access the content.

**Hybrid OA**: When a toll-access journal offers an option for an output to be made immediately OA upon the payment of a publication fee.

Over the following few decades, commercial publishers grew larger through acquisitions of content and mergers with other companies. The history of major business dealings for three of the largest commercial publishers reveals a tendency to direct capital towards acquiring content in the earlier phase, but starting around 2007 these publishers became increasingly interested in acquiring dissemination services and infrastructure.[15] This pattern matches the rebranding of large publishers as data analytics companies, who position their tools and metrics as key indicators of institutional performance (for example Elsevier tools and metrics are used in several influential University ranking lists). Today, the five largest for-profit publishers control over half the academic publishing market: Reed-Elsevier, Wiley-Blackwell, Springer, Taylor & Francis, and SAGE.[16]

TODAY, THE FIVE LARGEST FOR-PROFIT PUBLISHERS CONTROL OVER HALF THE ACADEMIC PUBLISHING MARKET

[15] G. Chen, A. Posada, and L. Chan, 'Vertical Integration in Academic Publishing: Implications for Knowledge Inequality', in *Connecting the Knowledge Commons — From Projects to Sustainable Infrastructure: The 22nd International Conference on Electronic Publishing – Revised Selected Papers*, ed. L. Chan and P. Mounier, Laboratoire d'idées (Marseille: OpenEdition Press, 2019), https://doi.org/10.4000/books.oep.9068.
[16] V. Larivière, S. Haustein, and P. Mongeon, 'The Oligopoly of Academic Publishers in the Digital Era', *PLOS ONE* 10, no. 6 (10 June 2015): e0127502, https://doi.org/10.1371/journal.pone.0127502.

The transition of academic publishing to a digital medium in the late 1990s was meant to reduce costs and improve access, but these benefits have largely failed to materialise. Academic publishing suffers from extreme market concentration, with the largest publisher processing around 20% of research articles produced each year. The failure of the academic publishing market has been surveyed in recent reports by OpenAIRE,[17] the European Commission,[18] and the International Science Council.[19]

The nature of academic journals as non-substitutable goods means they operate as mini-monopolies within their respective fields. Researchers are the consumers of journal subscriptions but are insulated from prices because the purchasing of licenses is typically conducted by institutional library staff. This means the academic publishing market is not subject to the usual forces which help to determine pricing, and publishers are instead free to regularly increase their fees above the rate of inflation, safe in the knowledge that institutions who have the capacity to pay will be required to maintain access to the scholarly record for their researchers, staff, and students.[20] New Zealand universities spend upwards of $60 million per year to access subscription content from academic publishers.[21]

NEW ZEALAND UNIVERSITIES SPEND UPWARDS OF $60 MILLION PER YEAR TO ACCESS SUBSCRIPTION CONTENT FROM ACADEMIC PUBLISHERS

But steadily rising prices and static or shrinking library budgets make the cancellation of titles inevitable, and even academics in wealthy countries are beginning to encounter difficulties accessing the research material they need,[22] a situation previously unique to the developing world. Large publishers use non-disclosure agreements to prevent pricing transparency, but official information requests have revealed wide variation in prices charged by publishers to different institutions for the same bundles of journals.[23] In addition, metrics produced by large publishers and analytics companies have become enmeshed in hiring and promotion systems at research organisations, further reinforcing their influence and reach. Publishers have wielded their power in ways which have skewed the market they operate in, and which have made the playing field unequal, both for subscribing institutions and new publishers wishing to enter the market.

[17] R. Johnson et al., 'Towards a Competitive and Sustainable OA Market in Europe: A Study of the Open Access Market and Policy Environment' (OpenAIRE, 28 February 2017), https://doi.org/10.5281/zenodo.401029.
[18] É. Archambault et al., 'Proportion of Open Access Papers Published in Peer-Reviewed Journals at the European and World Levels—1996–2013', Study to Develop a Set of Indicators to Measure Open Access (Brussels, Belgium: European Commission, 22 October 2014), https://science-metrix.com/sites/default/files/science-metrix/publications/d_1.8_sm_ec_dg-rtd_proportion_oa_1996-2013_v11p.pdf.
[19] International Science Council, 'Opening the Record of Science: Making Scholarly Publishing Work for Science in the Digital Era' (Paris, France: International Science Council, 10 March 2021), https://doi.org/10.24948/2021.01.
[20] K. Frazier, 'The Librarians' Dilemma: Contemplating the Costs of the "Big Deal"', *D-Lib Magazine* 7, no. 3 (March 2001), http://www.dlib.org/dlib/march01/frazier/03frazier.html.
[21] M. Johnson, 'Submission on Review of the Copyright Act 1994: Issues Paper' (Universities New Zealand, 2019), https://www.universitiesnz.ac.nz/sites/default/files/uni-nz/documents/Issues%20Paper%20response%20to%20MBIE.pdf.
[22] J. Brine, 'Overcoming Barriers: Access to Research Information Content. A UK Research Information Network Report', *Interlending & Document Supply* 38, no. 2 (1 January 2010), https://doi.org/10.1108/ilds.2010.12238bae.001.
[23] T. C. Bergstrom et al., 'Evaluating Big Deal Journal Bundles', *Proceedings of the National Academy of Sciences* 111, no. 26 (1 July 2014): 9425–30, https://doi.org/10.1073/pnas.1403006111.

Researcher behaviour is strongly influenced by a complex web of institutional incentives and disciplinary norms. Researchers are under constant pressure to "publish or perish" by publishing as many papers as possible in journals which have the highest possible Journal Impact Factor (JIF).[24] JIF is a proprietary metric calculated and administered by Clarivate Analytics, a company with over 8,000 employees which sells subscriptions and consulting services. The JIF was invented in the 1960s to summarise a journal's citation activity and was originally aimed at library staff deciding which titles to subscribe to. It is calculated by dividing the number of citations to articles published in a certain journal in the current year, by the number of articles published in the journal during the previous two years.[25] But the metric has since become the goal. The JIF is now widely misused as a shortcut to evaluate the perceived quality of individual articles and has even become the driving force behind the selection of research topics and questions.[26] The disconnect between the kinds of research that funders and reviewers profess to admire and the kinds they actually support is at least partly driven by their widespread reliance on evaluation practices that simplify research projects to a single number (with three decimal places). But highly novel papers—those with a high proportion of unique combinations of references—are seldom in the top 1% of highly cited articles three years after publication.[27] However, fifteen years after publication, highly novel papers are around 60% more likely to be in the top 1% of highly cited papers, and these kinds of papers are typically published in journals with low JIFs. Shallow numerical shortcuts such as JIF do little to highlight the kind of research likely to push the frontiers of knowledge in each field. The rise of digital publishing and the ways researchers now engage with digital articles means it is no longer relevant to transfer a journal's prestige and "symbolic capital" onto articles which no longer share the same physical medium with each other.

RESEARCHERS ARE UNDER CONSTANT PRESSURE TO "PUBLISH OR PERISH" BY PUBLISHING AS MANY PAPERS AS POSSIBLE IN JOURNALS WHICH HAVE THE HIGHEST POSSIBLE JOURNAL IMPACT FACTOR (JIF)

SHALLOW NUMERICAL SHORTCUTS SUCH AS JIF DO LITTLE TO HIGHLIGHT THE KIND OF RESEARCH LIKELY TO PUSH THE FRONTIERS OF KNOWLEDGE IN EACH FIELD

The transfer of copyright ownership over research articles from researchers or their institutions to publishers is widespread even though it is not necessarily required for publication and may not be in researchers' or institutions' best interests.[28] Subscription publishers typically send a Copyright Transfer Agreement (CTA) to the corresponding author following acceptance of their manuscript for publication in a journal. Sometimes a publisher will license back certain rights to the authors, but in most cases, publishers retain copyright ownership over the work and the authors must seek permission to reuse parts of their own work. Unsurprisingly, researchers have little time to engage with the legal subtleties of CTAs, and are therefore often confused about what they can and can't do

[24] G. A. Lozano, V. Larivière, and Y. Gingras, 'The Weakening Relationship between the Impact Factor and Papers' Citations in the Digital Age', *Journal of the American Society for Information Science and Technology* 63, no. 11 (2012): 2140–45, https://doi.org/10.1002/asi.22731.
[25] Clarivate Analytics, 'The Clarivate Analytics Impact Factor', *Web of Science Group* (blog), 2001, https://clarivate.com/webofsciencegroup/essays/impact-factor/.
[26] P. Wouters et al., 'Rethinking Impact Factors: Better Ways to Judge a Journal', *Nature* 569, no. 7758 (May 2019): 621–23, https://doi.org/10.1038/d41586-019-01643-3.
[27] P. Stephan, R. Veugelers, and J. Wang, 'Reviewers Are Blinkered by Bibliometrics', *Nature* 544, no. 7651 (April 2017): 411–12, https://doi.org/10.1038/544411a.
[28] J. P. Tennant et al., 'Ten Hot Topics around Scholarly Publishing', *Publications* 7, no. 2 (June 2019): 34, https://doi.org/10.3390/publications7020034.

with different versions of their articles.[29] There is a persistent belief within the academic community that publishers allow authors to email a copy of the final published version to anyone who asks for it. However, this practise is in breach of most major publishers' copyright policies. For example, Elsevier has one of the most liberal policies relative to other for-profit publishers, but authors are only allowed to email their final articles to students or colleagues they personally know for their personal use.[30] By relinquishing copyright ownership over their works, researchers and their institutions lose control over how their scholarly works may be shared. Anecdotal reports suggest publishers will sometimes supply a non-exclusive license to authors who refuse to sign a CTA. These agreements allow authors to retain copyright, and to license a bundle of rights to the publisher necessary for publishing the article. There are also examples of 'author addenda' which authors can add to CTAs and send back for acceptance by the publisher, but awareness and uptake of these practices remains low.[31]

THERE IS A PERSISTENT BELIEF WITHIN THE ACADEMIC COMMUNITY THAT PUBLISHERS ALLOW AUTHORS TO EMAIL A COPY OF THE FINAL PUBLISHED VERSION TO ANYONE WHO ASKS FOR IT. HOWEVER, THIS PRACTISE IS IN BREACH OF MOST MAJOR PUBLISHERS' COPYRIGHT POLICIES

Paywalled research is an intended outcome of the subscription model of academic publishing. There is increasing concern from governments and funders that paywalls serve the interests of publishers over and above those of the research community and wider public. Without affiliation to a subscribing institution, access to most publicly funded research costs between US$20-50 per article, or a larger fee for a time-limited subscription. It's often unclear if a particular research article is pertinent to the needs of the searcher before purchasing access, as only a short abstract is available to judge its relevance. Many people without access to research (and also many that do have access) use illicit means to read academic articles, such as SciHub (see Box).

WITHOUT AFFILIATION TO A SUBSCRIBING INSTITUTION, ACCESS TO MOST PUBLICLY FUNDED RESEARCH COSTS BETWEEN US$20-50 PER ARTICLE

Interested members of the public also benefit from the democratisation of knowledge supported by open access to publicly-funded research. For example, a Pew Research poll[32] reported that just over a quarter of US internet users looking for health information have hit a paywall during their search. Over 80% of these people attempted to find the same information elsewhere, while 13% gave up immediately. Only 2% of people actually paid for access, but respondents living in lower-income homes were far more likely to say they gave up compared to wealthier respondents. Academic paywalls exacerbate existing inequalities and deny potentially important information from reaching those who need it the most.

[29] A. Kohn and J. Lange, 'Confused about Copyright? Assessing Researchers' Comprehension of Copyright Transfer Agreements', *Journal of Librarianship and Scholarly Communication* 6, no. 1 (3 December 2018), https://doi.org/10.7710/2162-3309.2253.
[30] Elsevier copyright policy, https://www.elsevier.com/about/policies/copyright
[31] P. B. Hirtle, 'Author Addenda: An Examination of Five Alternatives', *D-Lib Magazine* 12, no. 11 (November 2006), https://doi.org/10.1045/november2006-hirtle.
[32] https://www.pewresearch.org/internet/2013/01/15/information-triage/

## What is SciHub?

Sci-Hub is an online archive of illegally-obtained full-text research articles created by Alexandra Elbakyan in 2011 to get around publisher paywalls.[33] In 2017, Sci-Hub servers housed over 60 million publications from over 170,000 journals, while over 95% of the 60 million+ downloads each year are for articles published after 1982 and over half of the downloaded articles come from less than 1% of the journals represented.[34] Elsevier filed a lawsuit against Sci-Hub in 2015 alleging violations of copyright and computer fraud laws, eventually winning a default judgement in 2017.[35] The American Chemical society filed a similar lawsuit in 2017 and won a default judgement, including a permanent injunction granted against any entities providing services for Sci-Hub. Elsevier, Wiley, and ACS filed a lawsuit against SciHub in India in 2021 alleging copyright infringement and asking the Delhi High Court to block internet access to the site in India.[36] Indian copyright law contains relatively generous provisions relating to "fair dealing" so the outcome could be in favour of SciHub. The Washington post reported rumours that officials in the US Justice Department are investigating Elbakyan for potential links with Russian intelligence agencies.[37] Sci-Hub has been praised by some members of the open science community for allowing access to millions of paywalled publications, but many librarians are concerned about the apparently wide and uncritical acceptance of Sci-Hub as a 'solution' to access barriers.[38] They argue a continued reliance on Sci-hub means a continued reliance on toll-access publishing. Sci-Hub also represents a security risk to university networks, as Elbakyan has admitted university credentials are obtained illegally to harvest content for the site.[39] Use of Sci-Hub on-campus is common even in wealthier countries, and this makes librarians liable for breaches of the contracts they hold with publishers.

Mis- and disinformation spread easily through the internet and are an ongoing concern for democratic governments, medical practitioners, and mainstream media outlets. Openly accessible peer-reviewed information should be easy to find, especially considering the ease with which pseudoscientific or conspiratorial information can be found. In the absence of peer-reviewed research, people are left to

[33] J. Bohannon, 'Who's Downloading Pirated Papers? Everyone', *Science* 352, no. 6285 (29 April 2016): 508–12, https://doi.org/10.1126/science.352.6285.508.
[34] B. Greshake, 'Looking into Pandora's Box: The Content of Sci-Hub and Its Usage', *F1000Research* 6 (21 April 2017): 541, https://doi.org/10.12688/f1000research.11366.1.
[35] D. S. Chawla, 'Court Demands That Search Engines and Internet Service Providers Block Sci-Hub', *Science | AAAS* (blog), 6 November 2017, https://www.sciencemag.org/news/2017/11/court-demands-search-engines-and-internet-service-providers-block-sci-hub.
[36] H. Else, 'What Sci-Hub's Latest Court Battle Means for Research', *Nature* 600, no. 7889 (13 December 2021): 370–71, https://doi.org/10.1038/d41586-021-03659-0.
[37] S. Harris and D. Barrett, 'Justice Department Investigates Sci-Hub Founder on Suspicion of Working for Russian Intelligence', *Washington Post* (blog), 19 December 2019, https://www.washingtonpost.com/national-security/justice-department-investigates-sci-hub-founder-on-suspicion-of-working-for-russian-intelligence/2019/12/19/9dbcb6e6-2277-11ea-a153-dce4b94e4249_story.html.
[38] R. Harrison, Y. Nobis, and C. Oppenheim, 'A Librarian Perspective on Sci-Hub: The True Solution to the Scholarly Communication Crisis Is in the Hands of the Academic Community, Not Librarians', *Impact of Social Sciences, London School of Economics* (blog), 9 November 2018, https://blogs.lse.ac.uk/impactofsocialsciences/2018/11/09/a-librarian-perspective-on-sci-hub-the-true-solution-to-the-scholarly-communication-crisis-is-in-the-hands-of-the-academic-community-not-librarians/.
[39] Harris and Barrett, 'Justice Department Investigates Sci-Hub Founder on Suspicion of Working for Russian Intelligence'.

fill the knowledge vacuum with whatever they can find. Openly accessible research would help to provide more transparency around the sources of information used to build policy: which sources of information are being used? What are the assumptions, claims, and conclusions presented in these sources? Which kinds of information are privileged over others?

PUBLISHERS THEMSELVES INDIRECTLY ACKNOWLEDGE THE HARM CAUSED BY PAYWALLS WHEN THEY AGREE TO TEMPORARILY REMOVE THESE BARRIERS TO LIFE-SAVING RESEARCH DURING PUBLIC HEALTH EMERGENCIES

Publishers themselves indirectly acknowledge the harm caused by paywalls when they agree to temporarily remove these barriers to life-saving research during public health emergencies. For example, many publishers were successfully pressured to remove paywalls to research relating to Ebola virus in 2013, Zika virus in 2016, and most recently SARS-CoV-2 virus in 2020, during outbreaks of disease. The rationale for removing paywalls was to allow more rapid communication of important epidemiological information, speed up research into vaccines, and improve the efficiency with which science could be translated into effective public health policy. These temporary removals of the paywall no doubt saved countless lives and sped up the translation of research into life-saving public policy. However, publishers have chosen not to provide access to research dealing with ongoing existential crises such as climate change and the environmental catastrophes it causes. They have also chosen to maintain paywalls to research relating to outbreaks of diseases associated with the global south such as dengue fever, African swine fever, malaria, or the resurgences of diseases such as measles. If open access to life-saving research is valuable and justified during times of crisis, then it is valuable and justified all the time to tackle the most important health crises and environmental calamities, wherever they may occur, and whoever they may affect.

# 3 The Open Research movement and open access

Open research (or open scholarship/science) refers to a set of principles and practices which emphasise the importance of transparency, accountability, reproducibility, accessibility, and collaboration in how scholarly research is designed, conducted, disseminated, and evaluated. The aim of open research practices is to make research more inclusive and more impactful by incorporating openness into each stage of the knowledge creation process. One of the pillars of open research is OA, which was defined at the Budapest Open Access Initiative in 2002 as the practise of making research literature freely available on the internet, under terms which allow most kinds of reuse, and where authors are properly acknowledged. Licenses attached to the work are used to clarify whether the work is 'Libre' (users have the right to reuse the literature for virtually any purpose), and/or 'Gratis' (users have the right to access the work for free).[40]

THE AIM OF OPEN RESEARCH PRACTICES IS TO MAKE RESEARCH MORE INCLUSIVE AND MORE IMPACTFUL BY INCORPORATING OPENNESS INTO EACH STAGE OF THE KNOWLEDGE CREATION PROCESS

The two main types of OA are called gold and green.[41] Gold OA refers to the publishing of research articles in fully OA journals, i.e., journals which only publish OA content. A database of gold OA journals

[40] P. Suber, *Open Access*, MIT Press Essential Knowledge Series (Cambridge, Mass: MIT Press, 2012), https://cyber.harvard.edu/hoap/Open_Access_(the_book).
[41] S. Harnad et al., 'The Access/Impact Problem and the Green and Gold Roads to Open Access', *Serials Review* 30, no. 4 (1 January 2004): 310–14, https://doi.org/10.1080/00987913.2004.10764930.

adhering to a set of minimum standards is maintained at the Directory of Open Access Journals (DOAJ). Gold journals can be divided into those which charge a publication fee, known as Article Processing Charges (APC-based journals) and those which are free to publish in (known as diamond/platinum journals). Green OA involves the deposit of the Accepted Manuscript (AM, the final peer-reviewed text before typesetting by the publisher) into an open repository in parallel with the publishing of an article in a toll-access (paywalled) journal. Publishers' policies mean most articles can be made OA through the green route,[42] but publishers have different terms and conditions they attach to this process. Hybrid OA refers to open access articles published in toll-access journals, but which are made open through the payment of an APC. Bronze OA is a recently coined term to denote articles which are available on publishers' websites, but whose OA status is unclear due to the absence of a license or any obligation for the publisher to continue to provide access.[43]

Open Access publishing has grown steadily since the first OA journals were published online in the early 1990s.[44] Between 2000 and 2009 the number of OA journals grew by an average of 18% each year, and the number of articles by 30%.[45] Growth in OA publishing is attributed to increasing interest in OA models, the expiration of embargo periods of previously published work, and the growth in academic publishing more generally. The number of articles published in gold and diamond journals doubled every 3.2 years between 1996 and 2013, so that by 2014, around half of the world's research articles produced each year were available online for free download.[46] Initiatives such as the San Francisco Declaration on Research Assessment[47] have promoted increasing interest in open research practices to improve the way research is conducted, disseminated, and evaluated.

The degree to which a country or institution embraces OA largely depends on the strength and reach of the OA policies they enact, and there are large discrepancies in the proportion of OA material at the national level. For example, a study comparing the largest universities around the world showed that UK tertiary institutions currently enjoy the highest rate of OA outputs with a median of 74%, and that 16 out of the top 20 universities for open access are in the UK.[48] A report produced by Dame Janet Finch in 2012 led to the provision of government funds to UK higher education institutions to pay for journal-based OA.[49] By comparison, most universities in the EU sit between 40-55%, those in the US sit around 51%, and those in Australia and Canada are below the global median of 43% (New Zealand universities were not included in this study). Academic disciplines also vary widely in their cultures of publishing and their interest in OA publishing. High-energy physics and mathematics are well-known for their high adoption of OA (>80%), primarily through ingrained cultures of posting pre-prints to servers such as ArXiv and SCOAP3, while pharmacy and chemistry often have very low rates of OA

[42] B.-C. Björk et al., 'Anatomy of Green Open Access', *Journal of the Association for Information Science and Technology* 65, no. 2 (2014): 237–50, https://doi.org/10.1002/asi.22963.
[43] H. Piwowar et al., 'The State of OA: A Large-Scale Analysis of the Prevalence and Impact of Open Access Articles', *PeerJ* 6 (13 February 2018): e4375, https://doi.org/10.7717/peerj.4375.
[44] Piwowar et al.
[45] M. Laakso et al., 'The Development of Open Access Journal Publishing from 1993 to 2009', *PLOS ONE* 6, no. 6 (13 June 2011): e20961, https://doi.org/10.1371/journal.pone.0020961.
[46] Archambault et al., 'Proportion of Open Access Papers Published in Peer-Reviewed Journals at the European and World Levels—1996–2013'.
[47] American Society for Cell Biology, 'San Francisco Declaration on Research Assessment', *DORA* (blog), 13 May 2013, https://sfdora.org/read/.
[48] N. Robinson-Garcia, R. Costas, and T. N. van Leeuwen, 'Open Access Uptake by Universities Worldwide', *PeerJ* 8 (8 July 2020): e9410, https://doi.org/10.7717/peerj.9410.
[49] T. T. Chan, 'Open Research Policies in the United Kingdom: Open Science Monitor Case Study' (Luxembourg: European Commission, January 2019), https://doi.org/10.2777/24416.

(<10%).[50] These disciplinary differences may explain why chemistry papers are over-represented in Sci-Hub.[51]

Higher rates of OA in the UK are the outcome of a sustained push by the government to support, and in many cases require, OA to publicly-funded research. A report by Dame Janet Finch in 2012 led to the provision of government funds to UK higher education institutions to pay for journal-based OA.[52] A commitment to OA was reaffirmed by the UK Minister for Universities and Science, David Willetts, in 2013.[53] UK Research and Innovation (UKRI), an umbrella organisation representing UK research councils, has required some form of OA publication since 2013. The UK Research Excellence Framework (REF), a scheme largely analogous to PBRF, has also required all outputs for consideration to be made available OA since 2016.

HIGHER RATES OF OA IN THE UK ARE THE OUTCOME OF A SUSTAINED PUSH BY THE GOVERNMENT TO SUPPORT, AND IN MANY CASES REQUIRE, OA TO PUBLICLY-FUNDED RESEARCH

The benefits of OA flow through researchers and their institutions out into wider society.[54] Researchers who make their work OA enjoy earlier citations, and eventually accumulate a higher number of citations than their colleagues who publish behind paywalls.[55] Some authors have suggested this may be because authors choose to publish their highest-quality work OA,[56] but other work has shown the OA citation advantage exists for both self-selected and mandated articles,[57] suggesting it is in fact reader self-selection toward accessing and citing open articles. Around two thirds of studies looking at citation counts for open vs closed articles find an OA citation advantage, and recent work suggests open articles receive 18% more citations than what is expected, while paywalled articles receive 10% fewer citations than expected.[58]

Open articles have also been shown to accumulate increased activity in 'alternative metrics' such as mentions on social media, blogging platforms, and mainstream media attention.[59] Increased citations and exposure are good for individual researchers who need to demonstrate different kinds of "impact" to secure competitive funding contracts or opportunities for career advancement. Institutions benefit from increased performance-based research funding and higher international rankings which attract a larger share of the lucrative international student market. Increased access to research also benefits

[50] Archambault et al., 'Proportion of Open Access Papers Published in Peer-Reviewed Journals at the European and World Levels—1996–2013'.
[51] Greshake, 'Looking into Pandora's Box'.
[52] Chan, 'Open Research Policies in the United Kingdom: Open Science Monitor Case Study'.
[53] David Willetts, 'Open Access Research' (Speech, Berlin Open Access Conference, Berlin, Germany, 20 November 2013), https://www.gov.uk/government/speeches/open-access-research.
[54] J. P. Tennant et al., 'The Academic, Economic and Societal Impacts of Open Access: An Evidence-Based Review', *F1000Research* 5 (21 September 2016): 632, https://doi.org/10.12688/f1000research.8460.3.
[55] G. Eysenbach, 'Citation Advantage of Open Access Articles', *PLOS Biology* 4, no. 5 (16 May 2006): e157, https://doi.org/10.1371/journal.pbio.0040157.
[56] P. Gaulé and N. Maystre, 'Getting Cited: Does Open Access Help?', *Research Policy* 40, no. 10 (1 December 2011): 1332–38, https://doi.org/10.1016/j.respol.2011.05.025.
[57] Y. Gargouri et al., 'Self-Selected or Mandated, Open Access Increases Citation Impact for Higher Quality Research', *PLOS ONE* 5, no. 10 (18 October 2010): e13636, https://doi.org/10.1371/journal.pone.0013636.
[58] Piwowar et al., 'The State of OA'.
[59] K. Holmberg et al., 'Do Articles in Open Access Journals Have More Frequent Altmetric Activity than Articles in Subscription-Based Journals? An Investigation of the Research Output of Finnish Universities', *Scientometrics* 122, no. 1 (1 January 2020): 645–59, https://doi.org/10.1007/s11192-019-03301-x.

government employees by allowing them to build policy informed by evidence. Health professionals and educators can incorporate the latest findings into evidence-based practise.

The idea that the general public are uninterested in research results and couldn't understand them even if they were allowed access is a view that both underestimates the public and reinforces the split between those who are credentialed and those who are not. Public debate around important or controversial issues is stifled when the primary research is not accessible to the public. Even though many science communicators do a good job at presenting research findings to a general audience, openly accessible primary research means people can get information directly from the source if they wish to. When people can see who funded and conducted the research, what the findings were, and which kinds of evidence were incorporated into policy, they are able to understand (and challenge) the rationale for decisions which may deeply affect their lives.

PUBLIC DEBATE AROUND IMPORTANT OR CONTROVERSIAL ISSUES IS STIFLED WHEN THE PRIMARY RESEARCH IS NOT ACCESSIBLE TO THE PUBLIC

Arguments against the underlying principles of OA are rare, but the viability of different policies or business models are frequently debated.[60] There is a common misconception that OA is immutably tied to "pay to publish" models, and that OA is therefore responsible for the rise of predatory publishing and supra-inflationary APC price increases. In fact, many of the most prestigious journals have always charged author-side fees regardless of whether or not the article is made OA, mostly for 'page charges' or colour figures. For example, *PNAS* charges US$1,640 for regular research articles and an extra US$1,500 for OA (or US$2,200 for authors whose funders require them to attach a CC BY license to the work). *Cell* charges US$1,000 for the first colour figure and US$275 for each additional one, while *Science* charges US$650 for the first and US$450 for each additional colour figure.

Some publishers claim earlier versions of research articles are inferior, while simultaneously claiming that if readers have access to Accepted Manuscripts then institutions will cancel their journal subscriptions.[61] Other publishers recognise that high levels of immediate green OA do not jeopardise the viability of subscription journals, an argument made early in the development of research repositories.[62] For example, SAGE has removed embargo periods for many of it's journals, and has never actively enforced embargo periods for the remainder. Publishing executives at SAGE have stated that there is "no evidence to say zero embargo periods negatively affect subscriptions",[63] and that, in their experience, there is no evidence to suggest libraries cancel subscriptions to journals in response to high rates of green OA. The main criticisms of OA tend to relate to the APC-based business models of hybrid and fee-charging OA journals. While about 70% of fully OA journals do not charge publication fees, most articles are published in fee-charging titles. This suggests the academic prestige economy (which frequently places a higher value on the venue of publication rather than the actual work) is

[60] J. Monaghan et al., '"APCs in the Wild": Could Increased Monitoring and Consolidation of Funding Accelerate the Transition to Open Access?' (Springer Nature, 2020), https://doi.org/10.6084/m9.figshare.11988123.v4.
[61] L. Ferguson et al., 'Open Post: The Rise of Immediate Green OA Undermines Progress', *Open Access Scholarly Publishing Association* (blog), 4 December 2020, https://oaspa.org/open-post-the-rise-of-immediate-green-oa-undermines-progress/.
[62] T. Berners-Lee et al., 'Journal Publishing and Author Self-Archiving: Peaceful Co-Existence and Fruitful Collaboration' (University of Southampton, 2005), https://eprints.soton.ac.uk/261160/.
[63] Richard Pell, 'Open Access: "No Evidence" That Zero Embargo Periods Harm Publishers', *Times Higher Education (THE)* (blog), 23 April 2019, https://www.timeshighereducation.com/news/open-access-no-evidence-zero-embargo-periods-harm-publishers.

operating for OA journals in much the same way it does for toll-access journals.[64] Publishers try to link the subscription model with peer-review, quality, curation, and access to the 'version of record', but OA channels can and do provide similar services to authors and readers.

Open Access mandates can help to shift research cultures and ensure that early adopters are not penalised. Although researchers are generally resistant to the introduction of more administrative requirements, they remain largely in favour of the philosophical and practical benefits of OA when made aware of the possibilities. For example, Swan and Brown[65] found that almost three quarters of authors who had never uploaded an AM to their institutional repository were unaware they were able to do this, but over 80% of authors would willingly comply with a funder or institutional green OA mandate. Most authors reported no difficulty in depositing their AMs into their institutional repository, a task which usually took only a few minutes. Understanding the needs of researchers and articulating the benefits of repository-based OA appear to be important activities for raising awareness amongst researchers and increasing the amount of content recruited into institutional repositories.[66] Aotearoa New Zealand researchers prioritise publishing traditional peer-reviewed articles in venues with the highest readership within their disciplines, and in this way, they largely reflect the dominant attitudes of researchers around the world.

A 2011 study of researchers from Aotearoa New Zealand showed that over half of respondents were unaware of the existence of their institutional repository, and only 24% of the total sample had ever deposited anything in it.[67] Three quarters of respondents were against compulsory deposit, and this may be due to over 90% of respondents believing articles reached a wider audience in journals. Non-depositors reported concerns about copyright, time burden, and plagiarism, suggesting a need for more education on the value of repository-based OA and practical advice on how to use repositories. In contrast to these results, a more recent CONZUL faculty survey of six out of eight Aotearoa New Zealand universities reported 72% of respondents were in favour of their institution enacting a policy requiring publicly funded research to be made available freely online.[68] A survey of Otago faculty found that Green OA was not widely practised or understood, but 86% of respondents agreed or strongly agreed that "research articles should be freely available to all".[69] These results largely echo the international literature which shows authors generally favour OA but lack the understanding of how to achieve it.[70]

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[64] H. Morrison et al., 'Open Access Journals & Article Processing Charges 2011 – 2021' (University of Ottawa (Preprint), 23 June 2021), https://ruor.uottawa.ca/bitstream/10393/42327/1/Open_access_journals_and_article_processing_charges_2011_2021_preprint.pdf.

[65] A. Swan and S. Brown, 'Open Access Self-Archiving: An Author Study', Departmental Technical Report (Cornwall, UK: UK FE and HE Funding Councils, May 2005), http://cogprints.org/4385/.

[66] N. F. Foster and S. Gibbons, 'Understanding Faculty to Improve Content Recruitment for Institutional Repositories', *D-Lib Magazine* 11, no. 01 (January 2005), https://doi.org/10.1045/january2005-foster.

[67] R. Cullen and B. Chawner, 'Institutional Repositories, Open Access, and Scholarly Communication: A Study of Conflicting Paradigms', *The Journal of Academic Librarianship* 37, no. 6 (1 December 2011): 460–70, https://doi.org/10.1016/j.acalib.2011.07.002.

[68] Ithaka S+R, 'CONZUL Faculty Survey: Aggregate Report of Findings' (Council of New Zealand University Librarians, 2018), https://library.victoria.ac.nz/library/sites/default/files/CONZUL%20Aggregate%20Faculty%20Survey%20Report%20of%20Findings-%20web%20version.pdf.

[69] M. Remy and R. K. A. White, 'University of Otago Open Access Publishing Survey Results (Including Maori Ethnicity Results)' (Dunedin, NZ: University of Otago, 24 May 2017), http://hdl.handle.net/10523/7333.

[70] Björk et al., 'Anatomy of Green Open Access'.

A SURVEY OF OTAGO FACULTY FOUND THAT GREEN OA WAS NOT WIDELY PRACTISED OR UNDERSTOOD, BUT 86% OF RESPONDENTS AGREED OR STRONGLY AGREED THAT "RESEARCH ARTICLES SHOULD BE FREELY AVAILABLE TO ALL"

# 4 Global developments in open access

Government funding agencies in Europe and North America have been engaging with open research since the mid-2000s (see Appendix One for a summary of major funder mandates). The first major governmental OA mandate was introduced in 2008 by the NIH in the United States, and this followed on from a voluntary policy enacted in 2005. All federally funded biomedical research in the US is subject to the NIH public access policy which requires researchers or publishers to deposit the Accepted Manuscript of peer-reviewed journal articles into PubMed Central (PMC). The National Centre for Biotechnology Information created PMC to accommodate research outputs captured by the public access policy, and the scope of its contents have expanded through partnerships with other government agencies and philanthropic research funders.

In 2012, a Working Group on Expanding Access to Published Research Findings was assembled by UK Minister for Universities and Science, David Willetts, and asked to review how public access to research could be improved. The recommendations in the resulting report, named after the chair of the committee Dame Janet Finch, included an emphasis on fee-based gold OA and government support to meet the extra costs of this approach.[71]

The following year saw the Obama administration direct all US federal departments and agencies spending over US$100 million per year on research to have a plan to support greater public access to these outputs.[72] Meanwhile, Research Councils UK introduced their first OA mandate requiring research they fund to be published in OA journals or have the Accepted Manuscript made available on a repository within 6-12 months of publication.

In 2014, the performance-based UK REF announced an OA mandate with similar requirements to the RCUK mandate for peer-reviewed articles to be considered for the REF exercise, and this mandate was enacted in 2016.[73] The Council of the European Union adopted a set of conclusions on the transition towards an open science system in May 2016.[74] Member states acknowledged the potential for open science practices to improve the quality, impact, and benefits associated with research, and agreed to coordinate their approaches to ensure open access to scholarly works became the default from 2020. In 2018, UKRI was created as an umbrella group containing RCUK, Innovate UK, and Research England. In the same year, cOAlition S—a consortium of national funding agencies and philanthropic funders primarily based in Europe—announced a set of principles (Plan S) which their grantees would have to abide by when publishing research funded by a member of the coalition.

[71] Chan, 'Open Research Policies in the United Kingdom: Open Science Monitor Case Study'.
[72] J. P. Holdren, 'Expanding Public Access to the Results of Federally Funded Research: Memorandum to the Heads of Executive Departments and Agencies' (Washington, DC: Office of Science and Technology Policy, 22 February 2013), https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf.
[73] Anonymous, 'REF 2021: Overview of Open Access Policy and Guidance' (UK Research Excellence Framework, November 2019), https://www.ref.ac.uk/media/1228/open_access_summary__v1_0.pdf.
[74] General Secretariat, 'Council Conclusions on the Transition towards an Open Science System' (Council of the European Union, 27 May 2016), https://data.consilium.europa.eu/doc/document/ST-9526-2016-INIT/en/pdf.

Plan S is an OA mandate consisting of ten principles which grantees will be required to comply with in order to receive research funding beyond 2021.[75] It is designed to incentivise publishers to transition their journals away from the subscription model, but is seen as controversial by many commercial publishers and researchers who question the pace of change and impacts on researchers from developing nations.[76] Researchers who accept funding from member organisations are required to retain copyright ownership of their published articles in order to make their work accessible and reusable, and articles must be published with an open license either through gold journals or zero embargo green OA. Funders agree to cover the costs of publishing in Gold OA journals, but only where publication fees are standardised and capped. Hybrid journals are not compliant with the policy unless they commit to transitioning to full OA and provide updates on their progress. The coalition will require publishers to share pricing and service data from July 2022.[77]

PLAN S IS AN OA MANDATE CONSISTING OF TEN PRINCIPLES WHICH GRANTEES WILL BE REQUIRED TO COMPLY WITH IN ORDER TO RECEIVE RESEARCH FUNDING BEYOND 2021

Some publishers believe zero embargo Green OA undermines the business structure which produces AMs for deposit, however, some publishers have already announced updated green OA policies for authors funded by cOAlition S.[78] Members of cOAlition S include UKRI and national research councils in Austria, Finland, France, Luxembourg, Norway, and Poland. Charitable funders include the Wellcome Trust, Gates Foundation, Howard Hughes Medical Institute, and the WHO. Statements supporting Plan S have been issued by over 25 research, funding, or publishing organisations. Currently no New Zealand or Australian organisations have joined cOAlition S. Plan S captures a significant proportion of annual global research output. For example, one of the three major philanthropic members was acknowledged on 5% of all research articles published in 2020,[79] and a corresponding proportion of Australian university publications are thought to be subject to these requirements.[80]

Several international bodies have recently announced their support and commitment to open research practices. The Group of 7 (G7) intergovernmental political forum announced their support for open research practices, including the importance of OA to research, in a declaration from science and technology ministers in response to the COVID-19 pandemic.[81] Ministers acknowledged the

[75] cOAlition S, 'Principles and Implementation | Plan S', 2018, https://www.coalition-s.org/addendum-to-the-coalition-s-guidance-on-the-implementation-of-plan-s/principles-and-implementation/.
[76] A. Manjarrez, 'As Plan S Takes Effect, Some Anticipate Inequitable Outcomes', *The Scientist Magazine* (blog), 3 August 2021, https://www.the-scientist.com/news-opinion/as-plan-s-takes-effect-some-anticipate-inequitable-outcomes-69058.
[77] Manjarrez.
[78] L. J. Hinchcliffe, 'AAAS Plan S Compliance Policy: Staying Committed to Subscriptions', *The Scholarly Kitchen* (blog), 28 June 2021, https://scholarlykitchen.sspnet.org/2021/06/28/aaas-staying-committed-to-subscriptions/; Anonymous, 'License to Publish' (American Association for the Advancment of Science, 2021), https://www.sciencemag.org/sites/default/files/2021_L2P_All%20Journals_Standard%20or%20Gov%27t%20Contractor%20with%20Plan%20S%20Addendum.pdf; STM Publishers, 'Statement on Rights Retention Strategy', *International Association of Scientific, Technical and Medical Publishers* (blog), 3 February 2021, https://www.stm-assoc.org/rightsretentionstrategy/.
[79] Holly Else, 'A Guide to Plan S: The Open-Access Initiative Shaking up Science Publishing', *Nature*, 8 April 2021, https://doi.org/10.1038/d41586-021-00883-6.
[80] D. Flanagan et al., 'Roadmap to Plan S for Australia: Final Report' (Council of Australian University Librarians, 8 May 2020), https://www.caul.edu.au/sites/default/files/documents/fair-access/caul2020roadmap-plans.pdf.
[81] G7, 'G7 Science and Technology Ministers' Declaration on COVID-19', *United States Department of State* (blog), 28 May 2020, https://www.state.gov/g7-science-and-technology-ministers-declaration-on-covid-19/.

importance of public access to research and data in responding effectively to the pandemic, and the ongoing importance of open science initiatives for improving the way research is conducted and incorporated into policy.

THE GROUP OF 7 (G7) INTERGOVERNMENTAL POLITICAL FORUM ANNOUNCED THEIR SUPPORT FOR OPEN RESEARCH PRACTICES, INCLUDING THE IMPORTANCE OF OA TO RESEARCH, IN A DECLARATION FROM SCIENCE AND TECHNOLOGY MINISTERS IN RESPONSE TO THE COVID-19 PANDEMIC

The United Nations Educational, Scientific and Cultural Organization (UNESCO) provisionally adopted a Recommendation on Open Science[82] in May 2021 and it was was adopted by all 193 member states of the UNESCO General Conference in November 2021. The Recommendation establishes common definitions and standards, shared values, and proposes a set of actions for the equitable implementation of Open Science principles at all levels of society. It acknowledges the challenges faced by stakeholders in developing nations, respects regional differences, and strives to be inclusive of Indigenous knowledge systems. The Recommendation explicitly recognises the collaborative nature of the scientific process and considers open access to scientific knowledge to improve the overall quality, reproducibility, and impact of science. It calls for all research materials (including publications, datasets, source code, protocols, images, and figures) to be openly licensed and deposited into open repositories supported and maintained by not-for-profit entities who will distribute and archive the works.

The International Science Council (ISC), an NGO representing scientific bodies from around the world, recently released a report after identifying concerns within its membership about the extent to which current academic publishing systems serve the research community and the public interest.[83] The global membership of the council provided strong support for the following recommendations:

- There should be universal open access to the record of science, both for authors and readers.
- Scientific publications should carry open licences that allow reuse and text and data mining.
- Rigorous and ongoing peer review is essential to the integrity of the record of science.
- The data/observations underlying a published truth claim should be concurrently published.
- The record of science should be maintained to ensure open access by future generations.
- Publication traditions of different disciplines should be respected.
- Systems should adapt to new opportunities rather than embedding inflexible infrastructures.

The Council of Australian University Librarians (CAUL) has completed several important programs of work in Australia, and the results of this work are highly relevant for New Zealand. A roadmap to Plan S in Australia[84] recommended aligning institutional policies and reward structures with Plan S to ensure in-scope publications produced in Australian universities complied with the mandate. A report on IP and copyright retention in Australian universities[85] found most institutions are not adequately

[82] Anonymous, 'Draft Text of the UNESCO Recommendation on Open Science' (Paris, France: United Nations Educational, Scientific, and Cultural Organisation, 2021), https://unesdoc.unesco.org/ark:/48223/pf0000376893?posInSet=7&queryId=64f6c09b-9508-4258-82a1-e195d9d38368.
[83] International Science Council, 'Opening the Record of Science'.
[84] Flanagan et al., 'Roadmap to Plan S for Australia: Final Report'.
[85] F. Bradley et al., 'Intellectual Property Rights Retention in Scholarly Works at Australian Universities Project Report' (Council of Australian University Librarians, 2020), https://www.caul.edu.au/sites/default/files/documents/fair-access/caul2020retaining-rights.pdf.

asserting their rights retention policies and are therefore missing out on the benefits of making their researchers' work more accessible and discoverable, for example through zero-embargo green OA.

A 2018 project on the financial impacts of APCs on Australian and New Zealand universities[86] found most institutions surveyed did not have a central APC fund, did not collect information on APC expenditure, and did not receive any APC information from funding bodies. While over 70 publishers were identified as recipients of APCs, six of these received around 75% of all payments, and the total estimated APC cost for just six Australian universities for 2017 was AU$3.7 million. A review of Australian repository infrastructure[87] found that, while repositories are serving researchers and their institutions well, more investment is needed to refresh and update aging services and to connect with international networks through membership in the Confederation of Open Access Repositories (COAR). New Zealand's eight universities are members of CAUL through their membership in CONZUL. Both countries already collaborate closely through these bodies, and continued collaboration serves the interests of researchers and funders in both countries.

# 5 Recommendations

## 1. Assemble a steering group to guide future work

A steering group should be assembled to coordinate the development and implementation of a national strategy for open research. Members should be drawn from key organisations and meet semi-regularly to discuss progress. The group should include Māori representation and have representatives from funders, policy makers, librarians and research practitioners. The steering group would meet at regular intervals to discuss progress towards developing and implementing a national strategy for open research. It could oversee the implementation of recommendations in this report, and it could coordinate efforts between key stakeholders within and outside of the research sector.

Membership could include:

- Ngā Pae o te Māramatanga
- Ministry of Business, Innovation and Employment
- The Royal Society of New Zealand Te Apārangi
- Health Research Council
- National Library of New Zealand
- Universities New Zealand Deputy Vice Chancellors Research committee
- Council of New Zealand University Librarians (CONZUL)
- Crown Research Institute Librarians
- OA Australasia
- Office of the Prime Minister's Chief Science Advisor

[86] S. Cramond et al., 'Fair, Affordable and Open Access to Knowledge: The Caul Collection and Reporting of APC Information Project', in *Proceedings of the IATUL Conferences* (Purdue University Libraries, 2019), 11, https://docs.lib.purdue.edu/iatul/2019/fair/2.

[87] CAUL, 'CAUL Review of Australian Repository Infrastructure' (Council of Australian University Librarians, March 2019), https://www.caul.edu.au/sites/default/files/documents/fair-access/repositories2019program-report.pdf.

## 2. Consult widely in partnership with Māori

The development and implementation of an OA mandate, and associated supporting activities, will require widespread and ongoing consultation with key communities, including funders, research institutions, and professional organisations. Most importantly, the consultation process should prioritise genuine engagement with Māori researchers and organisations, with a view toward managing and implementing a future mandate in partnership with Māori stakeholders. The New Zealand government has important constitutional responsibilities to act in partnership with Māori under Te Tiriti. Accordingly, for any science policy to be relevant in Aotearoa New Zealand it must be relevant and accessible to Māori. The benefits of open research will only be shared equitably if initiatives in this space are co-designed and co-managed by Māori.[88]

A rethink is needed into what constitutes 'impact' in the context of academic research in Aotearoa New Zealand and how current interpretations and incentives privilege certain groups. Metrics based on citations provide only a narrow understanding of how research is contributing to the wider discipline, and to the society and community in which it is conducted. For example, some researchers choose to make their data, software, methods, and other research materials publicly available for reuse, and to improve the reproducibility of their work, but are largely unrecognised for doing so. Some researchers achieve significant societal impact by providing their expertise and work for incorporation into policy, or through various outreach activities such as media appearances, teaching resources, or donating their time to mentor young people. Māori academics face the additional burden of being expected to educate their Pākehā colleagues in Te Ao Māori, and this extra work is almost always unrecognised, uncredited, and uncompensated.[89] In fact, a growing body of research is demonstrating how research institutions are failing to hire, retain, and promote a sustainable workforce of Māori and Pacifika scholars, despite their pledges of diversity, inclusion, and respect for Te Tiriti.[90]

MĀORI ACADEMICS FACE THE ADDITIONAL BURDEN OF BEING EXPECTED TO EDUCATE THEIR PĀKEHĀ COLLEAGUES IN TE AO MĀORI, AND THIS EXTRA WORK IS ALMOST ALWAYS UNRECOGNISED, UNCREDITED, AND UNCOMPENSATED

Open Access to publicly funded research articles has the potential to benefit Māori businesses and communities by unlocking the results of research relevant to their environmental, economic, health, and cultural interests. Greater access to research articles incorporating Mātauranga Māori principles could also help to foster a greater awareness and appreciation of Indigenous knowledge systems.

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[88] M. Hudson et al., 'Rights, Interests and Expectations: Indigenous Perspectives on Unrestricted Access to Genomic Data', *Nature Reviews Genetics* 21, no. 6 (June 2020): 377–84, https://doi.org/10.1038/s41576-020-0228-x.

[89] J. Haar and W. J. Martin, 'He Aronga Takirua: Cultural Double-Shift of Māori Scientists', *Human Relations*, 8 March 2021, 00187267211003955, https://doi.org/10.1177/00187267211003955.

[90] T. G. McAllister et al., 'Why Isn't My Professor Māori? A Snapshot of the Academic Workforce in New Zealand Universities', *MAI Journal: A New Zealand Journal of Indigenous Scholarship* 8, no. 2 (31 July 2019), https://doi.org/10.20507/MAIJournal.2019.8.2.10; Tara G. McAllister et al., 'Under-Represented and Overlooked: Māori and Pasifika Scientists in Aotearoa New Zealand's Universities and Crown-Research Institutes', *Journal of the Royal Society of New Zealand* 52, no. 1 (1 January 2022): 38–53, https://doi.org/10.1080/03036758.2020.1796103; S. Naepi, 'Why Isn't My Professor Pasifika? A Snapshot of the Academic Workforce in New Zealand Universities', *MAI Journal: A New Zealand Journal of Indigenous Scholarship* 8, no. 2 (31 July 2019), https://doi.org/10.20507/MAIJournal.2019.8.2.9; J. Kidman and C. Chu, 'Scholar Outsiders in the Neoliberal University: Transgressive Academic Labour in the Whitestream', *New Zealand Journal of Educational Studies* 52, no. 1 (2017): 7–19, https://doi.org/10.1007/s40841-017-0079-y.

However, history has shown that Indigenous peoples are often harmed in the pursuit of scholarly knowledge, for example, through a lack of inclusion and representation, a lack of informed consent, and the misuse of research data, samples or other materials.[91] Accordingly, Māori perspectives and tikanga should be woven through the consultation and implementation processes of a future OA mandate in Aotearoa New Zealand.

### MĀORI PERSPECTIVES AND TIKANGA SHOULD BE WOVEN THROUGH THE CONSULTATION AND IMPLEMENTATION PROCESSES OF A FUTURE OA MANDATE IN AOTEAROA NEW ZEALAND

The CARE principles for Indigenous Data Governance[92] affirm the rights of Indigenous peoples to engage in decision-making around the collection, storage, sharing, and reuse of data, and provide a framework to ensure both people and purpose are considered in the context of open research:

- Collective benefit: Data ecosystems shall be designed and function in ways that enable Indigenous Peoples to derive benefit from the data.
- Authority to control: Indigenous data governance enables Indigenous Peoples and governing bodies to determine how Indigenous Peoples, as well as Indigenous lands, territories, resources, knowledges and geographical indicators, are represented and identified within data.
- Responsibility: Those working with Indigenous data have a responsibility to share how those data are used to support Indigenous Peoples' self-determination and collective benefit. Accountability requires meaningful and openly available evidence of these efforts and the benefits accruing to Indigenous Peoples.
- Ethics: Indigenous Peoples' rights and wellbeing should be the primary concern at all stages of the data life cycle and across the data ecosystem.

Principles of trust, accountability, and equity should be central to this process to ensure Māori interests and perspectives are respected, particularly around issues such as privacy and Indigenous data sovereignty.[93]

Wide consultation across the sector is important to ensure buyin for any changes. Experience in the UK suggests funder mandates can be extremely effective in driving behavioural change amongst researchers and institutions, but extended periods of consultation are an essential prerequisite for this to happen. For example, some UK institutions have seen the proportion of their OA output go from 20% pre-mandate, to around 80-90% after a mandate was enacted. However, these successes were only possible through a process of consultation with researchers at each stage of the process in order to identify and address their concerns. When the requirements and benefits of an OA mandate are communicated clearly to researchers there can be widespread buy-in. For example, the Faculty of Arts and Sciences at Harvard University voted unanimously in 2008 to adopt an OA mandate requiring all faculty to provide the Accepted Manuscript to the University for upload into Harvard's repository.[94] The remaining eight faculties at Harvard have all adopted similar mandates in the years since. Surveys of university faculty in Aotearoa New Zealand show our academics strongly support the principles

[91] Hudson et al., 'Rights, Interests and Expectations'.
[92] Research Data Alliance International Indigenous Data Sovereignty Interest Group, 'CARE Principles for Indigenous Data Governance' (Global Indigenous Data Alliance, September 2019), https://www.gida-global.org/care.
[93] T. Kukutai et al., 'Te Pūtahitanga: A Tiriti-Led Science Policy Approach for Aotearoa New Zealand' (Auckland: Ngā Pae o te Māramatanga, 2021).
[94] https://osc.hul.harvard.edu/policies/

underlying open research, and OA in particular.[95] In fact, almost three quarters of respondents in a 2018 survey were in favour of a compulsory OA policy at their institution.[96]

Librarians, research support staff, institutional copyright advisors, and scholarly communication professionals, will be important groups to consult with, as they will be the ones helping researchers to comply with a mandate. Experience in the UK shows that professional associations have been very effective in developing and sharing best practices around workflows and processes to ensure their researchers understand the mandate and are compliant.

Professional associations such as the New Zealand Association of Scientists, New Zealand Association of Clinical Researchers, and Science Communicators Association of New Zealand should also be consulted to understand any questions or concerns their members may have. Aotearoa New Zealand is also home to many learned societies which represent a large number of working researchers across many disciplines, for example the New Zealand Institute of Chemistry, the New Zealand Mathematical Society, the Royal Australasian College of Physicians, and the New Zealand Ecological Society.

### 3. Undertake a review of academic publishing in Aotearoa New Zealand

A comprehensive review of academic publishing in Aotearoa New Zealand is essential to understand how our researchers publish their work, why they make the choices they do, and the potential long-term effects of their decisions. This review would include an inventory of local OA publishing options, an assessment of current infrastructure, and a review of current staffing and resource allocations to the scholarly communications and research support teams in our research institutions. A CONZUL-affiliated researcher is planning a review of journal publishing in Aotearoa New Zealand. A wider review could be built around this initiative.

The review should aim to answer the following questions:

- What is the total publishing output of NZ researchers, and how is this broken down by institution, discipline, and career stage?
- What kinds of journals do our researchers choose to publish in, and why do they make these choices?
- How much money is transferred to publishers for subscriptions to scholarly content, publication charges, and consulting services?
- What are the local APC-based and diamond OA journal options, how are they supported, and what are the long term challenges they face?
- What is the current capacity of our research institutions and infrastructure in supporting OA?
- How will different mandate options affect resourcing and staffing requirements needed to comply?
- What are the needs and interests of end-users of research produced in Aotearoa New Zealand, and how will they be effected by an OA mandate?
- How might overseas developments in academic publishing impact our researchers, and are there any opportunities our researchers could be better exploiting?

We do not have a broad picture of how researchers in Aotearoa New Zealand engage with the academic publishing market. In order to understand how changes in policy affect our researchers and their publishing output, we need baseline information on financial flows and costs associated with

[95] Cullen and Chawner, 'Institutional Repositories, Open Access, and Scholarly Communication'; Remy and White, 'University of Otago Open Access Publishing Survey Results (Including Maori Ethnicity Results)'.
[96] Ithaka S+R, 'CONZUL Faculty Survey: Aggregate Report of Findings'.

current publishing practices. A better understanding of local OA journal and platform options are sorely needed, especially if we're serious about fostering a healthy, bibliodiverse[97] publishing ecosystem that gives researchers genuine choice in publication venue and makes use of a variety of approaches to tackling the access problem. We need to understand more about our local diamond OA journals, what their technical capabilities are, and the challenges they are facing. For example, why do some local journals not issue DOIs and how might this affect the capture of statistics on OA rates?

A BETTER UNDERSTANDING OF LOCAL OA JOURNAL AND PLATFORM OPTIONS ARE SORELY NEEDED, ESPECIALLY IF WE'RE SERIOUS ABOUT FOSTERING A HEALTHY, BIBLIODIVERSE

The publishing behaviour of our researchers is inherently linked to the incentive structures imposed on them by funders and institutions. We need to understand how academic incentive structures—at the level of funders, institutions, and departments—are currently encouraging or discouraging researchers to engage with open research practices. For example, the reliance on metrics such as Journal Impact Factor (JIF) and Scimago Journal Rank (SJR) for assessing funding applications and promotions means that researchers are disincentivised to publish in diamond OA journals,[98] as these not-for-profit publications aim to serve a community of researchers, rather than chase metrics developed by commercial companies. International ranking systems currently incentivise institutions to prioritise the highest volume of publications in venues with the highest JIFs possible. But the extent to which current definitions of "impact" actually serve institutions, researchers, and the wider community is rarely considered. Current incentive structures may be acting as major barriers to uptake of open research practices. A wider view of how incentives affect publishing choices in Aotearoa New Zealand is desperately needed.

Current software, resourcing, and staffing requirements for our repositories are likely to be impacted by an OA mandate, so we need baseline information to understand current capacity. Librarians, research support staff, and administrators who work with repositories and publishing platforms are best positioned to communicate their needs.

Finally, a review of academic publishing should include a survey of the needs of key end-users of research produced here. For example, policymakers need access to research produced in and about Aotearoa New Zealand. Professional bodies and their members need access to research to stay abreast of important developments, incorporate innovative techniques in their practise, and to ensure they are tailoring their approaches to the unique needs of the communities in our country. It is currently unclear how public sector employees, medical professionals, educators, and other important end-users of research are obtaining the research they need in the face of commercial paywalls. Anecdotal reports suggest they simply do not have the access they require, or are forced to use sub-optimal, time-consuming, or illicit workarounds to gain access to research about New Zealand.

[97] K. Shearer et al., 'Fostering Bibliodiversity in Scholarly Communications: A Call for Action' (Zenodo (Preprint), 15 April 2020), https://doi.org/10.5281/zenodo.3752923.
[98] J. Bosman et al., 'OA Diamond Journals Study. Part 1: Findings' (Science Europe & cOAlition S, 9 March 2021), https://doi.org/10.5281/ZENODO.4558704.

IT IS CURRENTLY UNCLEAR HOW PUBLIC SECTOR EMPLOYEES, MEDICAL PROFESSIONALS, EDUCATORS, AND OTHER IMPORTANT END-USERS OF RESEARCH ARE OBTAINING THE RESEARCH THEY NEED IN THE FACE OF COMMERCIAL PAYWALLS

Industry are key end-users of research who help to translate new results into goods and services, jobs, and exports. Paywalled research is likely to contribute to lost opportunities, lost potential for innovation, and lost productivity for Aotearoa New Zealand's companies and entrepreneurs. The government has signalled a strong commitment to improving knowledge flows between the research system and industry, so understanding how open access would benefit business is a practical step in that direction.

A recent review of scholarly journal publishing in Australia[99] found that just over half (56%) of Australian journals were associated with non-profit organisations such as learned societies and around a quarter (26%) were associated with universities. Most were self-published, but about a quarter outsourced their publishing to commercial publishers based overseas (Taylor & Francis, Wiley-Blackwell, Elsevier, SAGE, LexisNexis, and Springer). About 40% of publications offer gold OA, and the overwhelming majority do so without charging a publication fee, while the remaining titles are split between hybrid OA and subscription journals. Understanding the characteristics of domestic journal publishing is important for identifying the sustainability of local publications, the choices available to authors, and the potential impacts of an OA mandate on local titles

## 4. Publish a roadmap for Open Research in Aotearoa New Zealand

A recent Council of New Zealand University Librarians (CONZUL) report took stock of the OA landscape in New Zealand universities, and found the lack of a coordinated approach to open research is holding us back.[100] New Zealand universities spent approximately $65 million on subscription access to journals in 2017, and a further $2.1 million on APCs. Only 41% of New Zealand research articles were OA in 2017. Most importantly, and perhaps most frustratingly, over 90% of closed articles could have been made OA through deposit in university repositories after up to two years post-publication, but these works are likely to remain closed due to the low uptake of repository use.[101] The return on investment could be much better. A recent report by Tohatoha NZ on OA in Aotearoa New Zealand[102] made several recommendations: a national approach is needed and should include the National Library, CONZUL, and The New Zealand Library Association (LIANZA); relevant government agencies should provide appropriate support for librarians, academics, and administrators to train researchers and manage key services; and more investment is needed in open infrastructure to expand our repository network to CRIs and ensure our platforms are up to the task of curating and preserving our national scholarly heritage.

[99] H. R. Jamali, S. Wakeling, and A. Abbasi, 'Scholarly Journal Publishing in Australia', *Learned Publishing*, 21 January 2022, https://doi.org/10.1002/leap.1446.
[100] CONZUL, 'Open Access in New Zealand Universities: An Environmental Scan', 2019.
[101] R. K. A. White et al., 'Only Two out of Five Articles by New Zealand Researchers Are Free-to-Access: A Multiple API Study of Access, Citations, Cost of Article Processing Charges (APC), and the Potential to Increase the Proportion of Open Access', *PeerJ* 9 (26 May 2021): e11417, https://doi.org/10.7717/peerj.11417.
[102] M. Henk et al., 'Centring Our Values: Open Access for Aotearoa' (New Zealand: Tohatoha, 2019), https://www.tohatoha.org.nz/Open-Access-Report-WEB.

NEW ZEALAND UNIVERSITIES SPENT APPROXIMATELY $65 MILLION ON SUBSCRIPTION ACCESS TO JOURNALS IN 2017, AND A FURTHER $2.1 MILLION ON APCS

Aotearoa New Zealand needs a roadmap for Open Research. A roadmap for Open Research would offer a high-level national plan for lifting research standards across the country and implementing best practices developed around the world. It would outline a vision for making local research open to everyone while respecting ethical, privacy, legal, and cultural considerations. It would provide a cohesive set of principles to guide open research practices in Aotearoa New Zealand and it would be aimed at funders and institutions in recognition of their ability to influence the norms and traditions of research practise. It would be based around a set of goals and milestones to take us from where we are now, to where we want to be in the not too distant future. Deciding where we want to be would require consultation with funders, Māori researchers and organisations, scholarly communication groups and librarians, learned societies, universities and CRIs, small independent research organisations, individual researchers, and the public. The roadmap would recognise that there can are important differences between academic disciplines when it comes to publishing practices, and that research encompasses a wide variety of academic activities and outputs.

Several notable open research roadmaps have been published recently. These roadmaps all set out national visions to achieve greater access to publicly funded research outputs, and they often make several related recommendations to support greater transparency in the research process. The Finnish Ministry of Education and Culture released their Open Science and Research Roadmap[103] in 2014. It outlines a policy to pursue open access to research outputs and their unrestricted reuse whenever possible. To support this vision, a number of objectives are proposed including support for education and training of researchers, support for open infrastructure which links outputs with wider information about the research projects, and support for translating open research into societal impact in policy, business, journalism and other areas.

The Association of European Research Libraries (Ligue des Bibliothèques Européennes de Recherche, LIBER) released an Open Science Roadmap[104] in 2018. The roadmap recognises the central place of libraries and librarians in making progress towards the objectives of open research and lays out a plan for how and why LIBER members can drive change in Europe. The French National Centre for Scientific Research (Centre National de la Recherche Scientifique, CNRS) released its Roadmap for Open Science[105] in 2019. It aims to accelerate progress towards the widespread adoption of open science practices, including making all CNRS-funded research open access, developing a research culture of data sharing consistent with FAIR principles (Findable, Accessible, Interoperable, Reusable), developing and promoting open infrastructure and tools, and transforming the way individual researchers are evaluated, including an explicit recognition of their contributions to openness. The roadmap will be supported by the French Department of Scientific and Technical Information and will include training programmes for specific services and general capabilities.

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[103] The Ministry of Education and Culture's Open Science and Research Initiative, 'Open Science and Research Leads to Surprising Discoveries and Creative Insights: Open Science and Research Roadmap 2014–2017', Reports of the Ministry of Education and Culture, Finlan (Finland: Ministry of Education and Culture, 2014), https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/75210/okm21.pdf?sequence=1&isAllowed=y.

[104] P. Ayris et al., 'LIBER Open Science Roadmap' (The Hague, Netherlands: Ligue des Bibliothèques Européennes de Recherche, 2 July 2018), https://doi.org/10.5281/zenodo.1303002.

[105] French National Centre for Scientific Research, 'CNRS Roadmap for Open Science' (France: Centre National de la Recherche Scientifique, 18 November 2019), https://www.science-ouverte.cnrs.fr/wp-content/uploads/2019/11/CNRS_Roadmap_Open_Science_18nov2019.pdf.

The Chief Science Advisor of Canada released a Roadmap for Open Science[106] in February 2020. It is built on a set of principles considering the importance of people, transparency, inclusiveness, collaboration and sustainability. It recommends federal departments and agencies make research outputs open access by January 2022, implement FAIR data practices by January 2025, and conduct extensive consultation with research stakeholders to draft an Open Science strategy for research conducted outside federal agencies.

The Swedish Government has issued a Directive on Open Access[107] instructing the Swedish National Library to promote and coordinate work on transitioning national research publications to Open Access. The Ministry of Education, Culture and Science in the Netherlands has developed a National Plan for Open Science[108], which sets out the expectation that publicly funded research will be "open when possible" and only "closed when it must be." The Republic of Slovenia has enacted a National Strategy for Open Access[109] in which it defines publicly funded research to be an essential part of its national heritage, and mandates open access to scientific publications as a matter of principle. These approaches all share a high-level recognition scholarly research is part of a nation's national heritage, and they all share a commitment to transition toward OA as soon as possible for as many research outputs as possible.

A ROADMAP FOR OPEN RESEARCH IN AOTEAROA NEW ZEALAND SHOULD TAKE A SIMILAR APPROACH TO INTERNATIONAL EXAMPLES

A roadmap for open research in Aotearoa New Zealand should take a similar approach to international examples. A core vision or purpose needs to be articulated together with a range of objectives and recommendations to support the realisation of that vision. A high-level vision and associated objectives or principles will be informed by what the drafter values, in combination with the feedback from consultation, and could include:

- An overarching strategy to guide progress towards the adoption of open research practices by researchers, institutions, and funders.
- To ensure all publicly-funded research is OA and accessible to all New Zealanders.
- To encourage greater transparency, accountability, and reproducibility in the research process.
- To minimise wasteful competition and unnecessary duplication of effort, and to enhance collaboration.
- To evaluate researchers and their work in meaningful ways and to recognise and reward researchers who engage in open research practices.
- To value a diversity of knowledge systems and to recognise how open scholarship can interface with Indigenous researchers in a culturally appropriate manner.
- To reconsider what research impact really means and to value the wider impacts on people, communities, and society.

[106] Open Science Roadmap Advisory Committee, 'Roadmap for Open Science' (Canada: Office of the Chief Science Advisor of Canada, February 2020), https://www.ic.gc.ca/eic/site/063.nsf/vwapj/Roadmap-for-Open-Science.pdf/$file/Roadmap-for-Open-Science.pdf.
[107] https://www.kb.se/samverkan-och-utveckling/oppen-tillgang-och-bibsamkonsortiet/open-access-and-bibsam-consortium/open-access.html
[108] https://www.openscience.nl/en/national-platform-open-science/national-plan-open-science
[109] https://www.gov.si/assets/ministrstva/MIZS/Dokumenti/ZNANOST/Strategije/National-strategy-of-open-access-to-scientific-publications-and-research-data-in-Slovenia-2015-2020.pdf

To achieve these kinds of objectives it will be necessary to articulate a specific set of goals and milestones. Some of these may include:

1. Thoroughly investigate how open research principles interface with Māori perspectives and interests. Imposing openness requirements on researchers who work with Indigenous communities and data can lead to tension, a lack of trust, and may have significant unforeseen consequences for participants.[110] Māori researchers with considerable experience in this area should be funded to design and lead work to understand the extent to which open research principles are compatible with Te Ao Māori and Indigenous data sovereignty. This work could investigate the desirability and feasibility of applying cultural licenses to work involving Māori data. For example, Local Contexts licenses are an Indigenous governance framework which seek to identify "ownership, access, and culturally appropriate conditions for sharing historical, contemporary and future collections of cultural heritage and Indigenous data."[111] These frameworks are currently implemented through the display of TK (Traditional Knowledge) and BC (Biocultural) Labels and Notices on published works. These notices outline the ways in which research can be shared or engaged with while respecting local community rules and protocols around sharing knowledge and data.[112] Local communities customise their own labels to fit with their unique local contexts. These notices support engagement with digital resources such as research articles and datasets by clarifying specific rules related to the community included in the research. For example, there may be sacred material which has gender or seasonal restrictions on access or use.
2. Work with local and regional scholarly communications organisations to coordinate on terminology and metadata standards. It will be essential to provide a clear and consistent glossary of terms relating to open access to avoid confusion over jargon. Similarly, repositories could ensure their use of terms and machine-readable tags in article metadata are consistent. It would be useful to understand the kinds of initiatives planned and already underway at research institutions and organisations from the wider GLAM sector in Aotearoa, in order to coordinate and share experiences or resources, where appropriate.
3. Assess progress made in the adoption of persistent identifiers such as ORCIDs across the research system. In a set of recent recommendations[113] to the Minister for Universities, the Chair of the Universities UK Open Access Coordination Group suggested REF move to mandate ORCIDs and to support their use by researchers and institutions. The 2016 NZ Research, Science and Innovation Domain Plan[114] identified adoption of ORCIDs as a critical component in building the New Zealand Research Information System (NZRIS). NZRIS is being developed by MBIE and released in a phased approach. It will eventually serve as a database holding a variety of metadata associated with research activity, outputs, and funding in New Zealand. A

[110] Hudson et al., 'Rights, Interests and Expectations'.
[111] https://localcontexts.org/about/about-local-contexts/
[112] J. Anderson and M. Hudson, 'The Biocultural Labels Initiative: Supporting Indigenous Rights in Data Derived from Genetic Resources', *Biodiversity Information Science and Standards* 4 (9 October 2020): e59230, https://doi.org/10.3897/biss.4.59230.
[113] A. Tickell, 'Open Access to Research Publications - 2018: Independant Advice' (UK Government, 2018), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/774956/Open-access-to-research-publications-2018.pdf.
[114] '2016 Research, Science and Innovation Domain Plan' (Wellington, NZ: Ministry of Business, Innovation, and Employment, September 2016).

Joint Statement of Principle[115] around the adoption of ORCID identifiers by researchers, research organisations, and funders in Aotearoa New Zealand was issued in 2016 by The Health Research Council, the Independent Research Association of New Zealand, the Ministry of Business, Innovation and Employment, the Ministry of Education, the Ministry for Primary Industries, the New Zealand Association of Scientists, the Royal Society of New Zealand, Science New Zealand, the Tertiary Education Commission, and Universities New Zealand. Signatories recognised the many benefits of ORCID and acknowledged that widespread adoption of persistent identifiers for researchers would align with government data and information management principles around transparency and openness. Signatories also agreed to commit to supporting ORCIDs as a common research identifier and agreed to strongly encourage their use across New Zealand's research system. The degree to which these commitments have been fulfilled and the speed of adoption across the research sector should be reviewed. It isn't just the proportion of researchers who have an ORCID which is important, but also the degree to which their ORCID contains useful information such as their affiliation and works, and the degree to which this information is public or viewable. Work could also be undertaken to assess whether the government or MBIE could mandate the use of ORCIDs for researchers who apply for public funding to incentivise faster and wider adoption. It is currently unclear whether this is possible due to Principle 13 of the Privacy Act 2020 which states organisations can only use persistent identifiers when it is necessary and that they must protect these identifiers from misuse.

4. Work to ensure information flows between funders, institutions, researchers, and publishers are as efficient as possible. This could include consultation with publishers to understand how they may better serve the needs of their customers and stakeholders in light of an OA mandate. This could include working with major publishers to design a 'code of conduct' between publishers, researchers, institutions, and funders to ensure expectations are clear.
5. Investigate the economics of alternative publishing models and how government, public funders, and institutions could appropriately support these. Toll-access journals place an unacceptable cost burden on the reader, while in many cases fee-based OA journals merely shift the burden to the authors of the work, or their funders. The general academic publishing process has been slow to adapt to emerging technologies and many publishing practices are stuck in a print paradigm. The long-term health of academic publishing is likely to rest upon alternative models which offer fresh approaches, and which fully exploit the opportunities offered by digital media. For example, a shared non-profit platform which hosts multiple diamond journals is likely to be far more cost-effective than paying commercial prices charged by companies aiming to deliver 30% profit margins to their shareholders. The Open Library of Humanities hosts 28 diamond journals and is supported by a consortium of libraries and from an initial charitable endowment. These kinds of alternative publishing models appear to be more compatible with the missions and values of funders and institutions than current offerings, but institutional inertia has preserved the status quo. An economic assessment is needed to understand the scalability and financial viability of such models, and the return on investment if the government, funders, or institutions were to back them.

[115] ORCID Working Group, 'Joint Statement of Principle: Adoption and Use of ORCID Identifiers in New Zealand' (The Royal Society Te Apārangi, July 2016), https://www.royalsociety.org.nz/assets/documents/ORCID-Joint-Statement-of-Principle.pdf.

Aotearoa's Open Research Roadmap should align with and make reference to important developments and shifts already under way in the RSI sector. For example,

- MBIE's Draft RSI Strategy & Te Ara Paerangi- Future Pathways programme looking at the future of New Zealand's science sytem
- The Royal Society Te Aparangi's work on Redefining Research Excellence
- Cross government agency work Mātauranga Māori and the WAI 262 claim
- Archives NZ

## 5. Endorse the principles of Open Research

The New Zealand Government already accepts the importance of OA through the adoption of the NZGOAL framework. The New Zealand Government Open Access Licensing framework (NZGOAL) encourages the release of government works into the public domain for reuse and explicitly recognises the importance of open licensing for this process to work optimally.[116] NZGOAL acknowledges that state services agencies produce large amounts of material which may harbour significant creative and economic potential, and that individuals and organisations should be allowed to make use of this material for wider public benefit. State services agencies who release copyrighted material are directed to apply a Creative Commons license, while a "no known rights" statement is favoured for non-copyright works. Importantly, NZGOAL recognises that restrictions on accessing such material are only justifiable "on the basis of national security, confidentiality, privacy and respect for subjects of study, legal process and public order, the protection of intellectual property rights, personal information and the protection of human subjects, of sacred and secret Indigenous knowledge, and of rare, threatened or endangered species." Currently NZGOAL only covers material released by state services agencies and has not been expanded to include Tertiary Education providers or Crown Entities such as Crown Research Institutes. An endorsement of the principles of open research would complement NZGOAL by expanding the expectation of transparency and openness into the public research sector. Creative Commons licenses are already the prevailing licensing mechanism for OA research publications.

There are several opportunities for Aotearoa New Zealand to endorse the principles of open research by adopting official multilateral agreements or signing declarations. New Zealand should adopt the UNESCO Recommendation on Open Science,[117] the draft text of which was recently ratified at the UNESCO General Conference. The Recommendation considers open research practices to improve the quality, transparency, and reproducibility of research, and therefore the reliability of evidence needed for policy actions to confront the challenges facing humanity. Public access to information also underpins other UN initiatives, such as the Sustainable Development Goals adopted in 2016. A joint statement by UNESCO and COAR recognises that "as the world enters a new era of sustainable development, openness and inclusiveness in scientific research will become increasingly critical."[118]

[116] Public Services Commission, 'New Zealand Government Open Access and Licensing Framework (NZGOAL)' (Wellington, NZ: New Zealand Government, December 2014), https://www.data.govt.nz/assets/Uploads/nzgoal-version-2-december-2014.pdf.
[117] Anonymous, 'Draft Text of the UNESCO Recommendation on Open Science'.
[118] https://www.coar-repositories.org/files/coar_unesco_oa_statement-1.pdf

NEW ZEALAND SHOULD ADOPT THE UNESCO RECOMMENDATION ON OPEN SCIENCE, THE DRAFT TEXT OF WHICH WAS RECENTLY RATIFIED AT THE UNESCO GENERAL CONFERENCE.

The New Zealand Government, and/or our large public research funders, should join the thousands of organisations around the world (including public funding bodies in the US, UK, and EU) by signing the San Francisco Declaration on Research Assessment[119] (DORA). This would commit them to move away from misused metrics when evaluating the quality of research or researchers, and instead embrace more sophisticated and meaningful approaches to evaluating the actual merits of the research. For example, the total research output of an individual should be used to assess their eligibility for hiring, promotion, or the awarding of funding, and not just peer-reviewed journal articles. Finally, the Leiden Manifesto for Research Metrics[120] sets out ten principles to ensure the use of metrics to evaluate research is sound and ethical. Core to the Manifesto is the idea that scientometrics should be used as instruments rather than being allowed to become the goal. Institutions and funders should be explicit about the criteria they are using to judge applicants and they should review how these criteria fit with wider understandings of impact.

## 6. Consider appropriate options for an OA mandate

Large public funding bodies in North America and Europe have required open access mandates to publicly-funded research articles for some time. For example, UKRI, the UK REF, and the NIH in the United States all expect articles arising from their grants to be made OA in some form. In general, these mandates tend to require authors (or the author's institution) to publish in-scope articles in a suitable OA journal (gold OA), or to deposit the Accepted Manuscript in a suitable repository (green OA). All peer-reviewed articles describing the results of research funded in whole or in part by the respective agency are usually considered in scope, while conference papers, monographs and books, data, code, protocols, and other research materials are usually not considered in scope. Ideally, Aotearoa New Zealand's research funders would adopt a shared national-level mandate to ensure researchers are clear on their obligations and treated consistently.

Three major strategies for developing a national-level OA mandate are presented below. These options were chosen following an evaluation of the strategies pursued by large public funders overseas, and by reflecting on options which may be suitable for Aotearoa New Zealand.

### Option One: Plan S

Plan S[121] is a set of conditions requiring researchers to publish their articles in OA journals, on OA platforms, or on OA repositories, when they have received funding from a member of cOAlition S, a group of large national, regional, and international research funders. The Plan comes in to force in 2021 but each member of the coalition is given autonomy to implement the principles in their own way and in their own time. The main requirements are:

- Authors or their institutions retain copyright in all versions of their publications.
- Research articles are published immediately OA in a journal, on an OA platform, or the Accepted Manuscript is made available through a public repository with no embargo period, and all cases the work is licensed for reuse with a suitable Creative Commons license.

[119] American Society for Cell Biology, 'San Francisco Declaration on Research Assessment'.
[120] Hicks, D., Wouters, P., Waltman, L. et al. Bibliometrics: The Leiden Manifesto for research metrics. *Nature* 520, 429–431 (2015). https://doi.org/10.1038/520429a
[121] cOAlition S, 'Principles and Implementation | Plan S'.

- Funders cover reasonable APCs, but not for Hybrid journals, unless the journal has committed to flipping to OA within a clearly defined timeframe.

The proportion of Aotearoa New Zealand's annual research output funded by a member of cOAlition S, and therefore subject to the requirements of Plan S already, is currently unknown. In Australia, around 5% of university publications are in scope.[122] A significant proportion of global research output is subject to Plan S requirements, and this is only likely to increase as the membership of cOAlition S grows. Joining Plan S would mean that Aotearoa New Zealand research funders and institutions would not need to reinvent the wheel with their own bespoke mandate, and publishers are already adjusting their policies to accommodate authors funded by cOAlition S.

However, Plan S is seen as controversial by many publishers because it overrules the terms around copyright, licensing, and embargoes which up until recently, have allowed publishers to exercise considerable power in the way that research articles are owned and distributed. Articles or Accepted Manuscripts subject to Plan S are required to be published under a Creative Commons Attribution license, which means they can be reused in virtually any way as long as the work is attributed to the authors. In addition, Accepted Manuscripts must not be published after an embargo period following publication of the 'version of record' in the journal. The cOAlition contacted 150 of the largest academic publishers to notify them of these terms, and only one small society publisher has formally refused to accept submissions from authors funded by cOAlition S. Publishers have responded in different ways to Plan S requirements.[123] Some have committed a selection of their hybrid journals to become 'transformative' titles (journals which have committed to transitioning to only publishing OA content within a certain time-frame), or introduced paid OA publishing options (for example *Nature* now offers OA publication for NZ$16,000 per paper). Others have amended their terms to allow authors subject to Plan S to publish their Accepted Manuscripts without an embargo (for example *Science* and *The New England Journal of Medicine*). But it's currently unclear how publishers are responding to Plan S authors who submit to journals which have not committed to flipping to full OA or do not offer amended terms for Accepted Manuscripts.

While cOAlition S is an informal alliance of funders and research institutions, if the New Zealand government or it's public research funders wanted to join they would be expected to implement the principles of Plan S within a certain timeframe. In practical terms, this would mean:

- Paying reasonable publication charges levied by fully OA journals, with the option to also cover publishing charges levied by hybrid journals where a transformative agreement is in place.
- Ensuring all in-scope work is published under an open license (usually CC BY), and ensuring researchers or their institutions retain copyright in these works.
- Broadly support the transition to OA by encouraging other research-related organisations to adopt similar policies.
- Commit to eventually including monographs and books within the list of in-scope works covered by the policy.
- Monitor compliance and sanction non-compliance.
- Commit to assessing research outputs on the intrinsic merits of the work rather than the venue of publication or associated metrics such as Impact Factor or other publisher metrics.

[122] Flanagan et al., 'Roadmap to Plan S for Australia: Final Report'.
[123] Else, 'A Guide to Plan S'.

## Option Two: National 'Read and Publish' Agreements

The Chief Scientist of Australia, Dr Cathy Foley, has advocated for higher rates of open access to publicly funded Australian research since she was appointed in 2021. Dr Foley estimates that the Australian government spends AU$12 billion per year on research, most of which ends up behind a publisher paywall.[124] Australian universities and research institutes then spend up to another AU$1 billion per year so their researchers can read that work. Dr Foley elegantly articulates the problems with the current academic publishing market when she identifies the "tension between the need for research institutions to disseminate their research outputs as widely as possible to increase impact and citations, and the publishers' commercial drivers to transfer copyright ownership from authors, lock the research up in closed access databases, and then sell access back to only those who can afford it."[125] The result of such an arrangement, Dr Foley points out, is a system containing a lot of money and not a lot of consistency or efficiency. Each institution has its own arrangements and agreements with publishers, and access to the literature is therefore fragmented and patchy. She believes a redesign could save money and achieve greater impact.

Dr Foley has proposed a national-level Australian open access strategy based on repurposing the existing national spend on journal subscriptions and publication fees into a centralised fund used to negotiate agreements with each publisher on behalf of all Australian institutions. These agreements would cover subscription costs so that everyone residing in Australia would have read access to the publishers' catalogue of journals, and publication charges so that Australian research output could be published in OA journals and be accessible to everyone in the world.

Transformative agreements seek to shift payment from an institution or consortium away from subscription read access towards open access publishing charges.[126] They are normally negotiated between an institution (or a consortium of institutions) and a publisher. For example, the Council of Australian University Librarians consortium have negotiated transformative agreements with a number of publishers, such as Springer Nature, Wiley, and Oxford University Press, and these agreements apply to New Zealand universities.[127] The agreement described by Dr Foley is called a 'read and publish' agreement, because payment for reading and publishing is bundled together under a single contract. On the other hand, a 'publish and read' agreement is one in which the publisher receives money only for publishing costs, and read access is bundled in at no additional cost.

Typically the institution will try to strike an agreement which is cost-neutral (or they may even achieve a reduction in total spend if they are large enough and good at negotiating). In 2019, the University of California cancelled subscriptions with Elsevier after it's negotiations with the publisher broke down. But a new four-year publish and read deal was recently announced between UC and Elsevier, starting at USD$10.7 million in the first year and rising 2.6% each year after.[128] The UK higher education sector has recently concluded negotiations with Elsevier on a three-year OA agreement which provides unlimited OA publishing and unlimited read access to Elsevier journals. The UK spent about £50 million

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[124] C. Foley, 'An Australian Model for Open Access', https://oa2020.org/wp-content/uploads/POSTER_12_OpenAccessForAustralia_poster_DrCathyFoley.pdf.
[125] C. Foley, 'Unlocking the Academic Library: Open Access', Office of the Chief Scientist, 25 October 2021, https://www.chiefscientist.gov.au/news-and-media/unlocking-academic-library-open-access.
[126] L. J. Hinchliffe, 'Transformative Agreements: A Primer', *The Scholarly Kitchen* (blog), 23 April 2019, https://scholarlykitchen.sspnet.org/2019/04/23/transformative-agreements/.
[127] Council of Australian University Librarians, 'Read & Publish Agreements Negotiated by CAUL', 2022, https://caul.libguides.com/read-and-publish/home.
[128] L. J. Hinchcliffe, 'The Biggest Big Deal', *The Scholarly Kitchen* (blog), 16 March 2021, https://scholarlykitchen.sspnet.org/2021/03/16/the-biggest-big-deal/.

on subscriptions and publishing charges with Elsevier in 2021, and the new deal reduces this spend by about 25%.[129]

While there are potential cost-savings to be made through transformative agreements, there are some important challenges likely to accompany Dr Foley's approach of a national agreement with many publishers. Such a plan would require the centralising of a massive number of funds into a single source, managed by a single entity, and it's unclear how funds would be repurposed in this way. Universities are unlikely to accept a reduction in government funding so that some may be diverted to a new entity, particularly as the publishing output from each university is different. It also remains to be seen if there will be caps in place on the free OA publishing output of each university, and if so, how this will be determined equitably. Negotiating an agreement between a single institution and publisher can be complex and take a long time. Negotiating agreements with many publishers will be challenging, and its unclear how many publishers will be included. While a handful of the largest publishers are responsible for publishing the majority of global research outputs each year, there is a long tail of smaller publishers who publish a smaller number of journals which are important for certain fields. A national level transformative agreement may also result in further entrenching the dominance of large commercial publishers if smaller vendors are excluded. It's also difficult to predict how an Australian approach to open access will gel with international directions and initiatives.

For this strategy to be relevant for Aotearoa New Zealand, there would need to be enough money in the current system to repurpose toward transformative agreements with major publishers. It remains unclear if this is the case, and if such a strategy would represent good value for funders and researchers here. Negotiating agreements with 100+ major publishers would likely represent a complex and difficult endeavour, and it's unclear what would happen with the long tail of publishers which publish only one or a few journals, but which can be important publication venues for niche disciplines.

### Option Three: Institutional Rights Retention

In February 2008, the Harvard Faculty of Arts and Sciences voted unanimously to adopt a resolution introducing an OA mandate by way of institutional rights retention.[130] Each faculty member agreed to grant Harvard permission to exercise copyright in their scholarly articles, and to make them available through an OA repository (Harvard's DASH repository). Faculty members agreed to provide a pdf version of the accepted manuscript (the final peer-reviewed text before copyright is transferred to the publisher, and before typesetting occurs). In legal terms, this was achieved by granting:

"A nonexclusive, irrevocable, paid-up, worldwide license to exercise any and all rights under copyright relating to each of his or her scholarly articles, in any medium, and to authorize others to do the same, provided that the articles are not sold for a profit. The policy will apply to all scholarly articles written while the person is a member of the Faculty except for any articles completed before the adoption of this policy and any articles for which the Faculty member entered into an incompatible licensing or assignment agreement before the adoption of this policy. The Dean or the Dean's designate will waive

[129] Anonymous, 'Briefing on Elsevier ScienceDirect Agreement', University of South Wales Library (University of South Wales, 24 March 2022), https://library.southwales.ac.uk/news/library-news-2022/briefing-elsevier-sciencedirect-agreement/.

[130] P. Suber, 'The Open Access Mandate at Harvard', in *Knowledge Unbound* (Cambridge, Massachusetts: MIT Press, 2019), https://knowledgeunbound.mitpress.mit.edu/pub/4sev527q/release/1.

application of the policy for a particular article upon written request by a Faculty member explaining the need."[131]

Other faculties followed suit so that by 2014 all of Harvard's faculties had adopted a similar policy. The most recent update to the wording of the license was made in 2018.[132]

Importantly, Harvard does not claim ownership over the articles, just a non-exclusive license. However, this means authors are unable to transfer the usual bundle of rights to the publisher when publishers ask them to sign a copyright transfer agreement. Under such a mandate, faculty own their work "subject to" the Harvard license, and may still transfer their rights to publishers, subject to the same condition. This means publishers cannot be granted an exclusive license to exercise copyright in the work, so publishers can never claim copyright infringement when the AM is immediately made available on an institutional repository. This avoids the copyright-related issues associated with voluntary policies, where institutions encourage or require the deposit of AMs, but not when this would breach publisher requirements. Voluntary policies provide an automatic opt-out for publishers who are then rewarded for imposing anti-archiving terms. A Harvard-style mandate means publishers can only reject the author's preference for OA based on their inherent right to refuse to publish something, not because the author is breaching the publisher's terms, as is claimed with authors complying with the immediate green OA requirements of Plan S. Were publishers to refuse publication on the basis of an institutional rights retention policy, all of their journals would be required to desk-reject every paper submitted from that institution.

While the Harvard mandate is not the first of it's kind, that being the mandate adopted in 2004 by Queensland University of Technology, it has gained the most attention. This is because Harvard is considered to be a prestigious institution, the mandate was unanimously adopted by faculty (not imposed by administrators), and it was the first mandate to focus on permissions rather than compulsory deposit. The unanimous support of faculty is consistent with other research findings showing researchers largely agree with the arguments in favour of OA mandates and most would willingly comply with an institutional mandate if one were introduced.[133] The success achieved by Harvard's Faculty of Arts and Sciences came down to the careful consideration of wording and legal strategy, patient lobbying by the architect of the mandate, thorough consultation with faculty, and the inclusion of a clause guaranteeing a waiver for any researcher who requests one in writing.

RESEARCHERS LARGELY AGREE WITH THE ARGUMENTS IN FAVOUR OF OA MANDATES AND MOST WOULD WILLINGLY COMPLY WITH AN INSTITUTIONAL MANDATE IF ONE WERE INTRODUCED

Harvard's strategy of communicating it's expectations to researchers, consulting with them to discuss the benefits, supporting compliance and offering incentives, even while including an opt-out clause and refusing to sanction non-compliance, changes the default behaviour to archiving accepted manuscripts, and switches the burden from the complier to the dissenter. By asking faculty to email a copy of their AM to a person designated by the institution, the mandate reduces the perceived barriers around time and effort that would come with a mandate asking the faculty members to deposit their

[131] Suber.
[132] Harvard Library, 'Individual Open Access Licence', Harvard Office of Scholarly Communications, 2018, https://osc.hul.harvard.edu/policies/ioal/.
[133] Swan and Brown, 'Open Access Self-Archiving'.

own AMs (even though the time and effort to deposit is significantly less than many researchers fear[134]).

This approach is working reasonably well for Harvard. According to Peter Suber, the Director of the Harvard Office for Scholarly Communication, faculty have remained supportive of the policy. Harvard authors opt for a waiver for below 5% of articles covered by the policy, even though all they have to do is tick a box on a webform. Most of these waivers are the result of two or three publishers asking authors to request a waiver, in the knowledge that the institution is guaranteed to grant one. On average, it takes the institution around 4-5 months to find eligible papers, attach relevant metadata, and deposit into the repository. Authors sued to be able to do it on their own, but the university now uses a mediated deposit system where staff check to ensure good metadata is added to each item. Dr Suber is unaware of a single case where a submitted manuscript was ultimately rejected by a publisher because of Harvard's institutional rights retention policy. The more institutions that make use of a rights retention strategy the stronger the strategy becomes, because publishers can't afford to desk-reject the entire publishing output of many institutions. This is especially the case when the authors or their institutions carry a 'prestigious' reputation.

A common misunderstanding of institutional rights retention policies includes the idea that faculty may only submit to journals which allow immediate repository-based OA for the accepted manuscript. In cases where a publisher does not normally allow immediate green OA, the author can ask it to so in this case with an author addendum, or the publisher can ask the author to request a waiver. This means faculty will still be able to submit to any journal they like, provided the publisher does not enact a blanket non-acceptance policy due to the rights retention policy. A similar misunderstanding is the idea that such an institutional policy violates journal policies around repository-based OA. If a journal won't accept a submission due to the policy then authors are free to request a waiver, but if they don't, then the author is free to look for another publisher and would be in the same position as any other author with a rejected manuscript.

Several prestigious universities have recently signalled an interest in a rights retention policy, or have adopted one.

The University of Edinburgh updated it's 2010 Research Publications Policy in 2021 with a mandatory policy[135] now requiring all researchers to grant the University a non-exclusive licence to make their manuscripts publicly available through the institutional repository under the terms of a Creative Commons Attribution (CC BY) licence. As with Harvard, the University of Edinburgh provides opt0out by way of an online form which must be filled out for each relevant publication. Cambridge University began an opt-in pilot project[136] in April 2022 investigating how a rights retention policy works 'on the ground' and how it may affect Cambridge researchers. The pilot will run for one year and results will be used to inform the next review of their policy, which is based on the approaches taken by Harvard University and the University of Edinburgh. Cambridge has already shared information relating to it's experiences.[137]Rights retention policies such as the one used by Harvard offer a promising strategy for institutions to make more of their research output open, but they remain untested at the national

[134] Swan and Brown.
[135] https://www.ed.ac.uk/information-services/about/policies-and-regulations/research-publications
[136] https://www.openaccess.cam.ac.uk/funder-open-access-policies/rights-retention/rights-retention-pilot
[137] https://www.coalition-s.org/blog/how-to-make-it-right-a-rights-retention-pilot-by-the-university-of-cambridge-ahead-of-shaping-a-full-institutional-policy/

level. If such a policy were to be adopted by funders in Aotearoa New Zealand the wording would likely need to be tweaked to accommodate the considerations unique to doing research here.

For a national-level rights retention policy to work effectively, authors based at Crown Research Institutes, other independent research institutes, and those unaffiliated with any research organisation would need a suitable repository to host their work. Ideally, such a repository would be provided by The National Library of New Zealand | Te Puna Mātauranga o Aotearoa. The National Library is trusted to collect, preserve, and protect Aotearoa's documentary heritage, including digital documents. It collaborates with a wide variety of other institutions and individuals who share similar purposes, and as New Zealand's legal deposit library, it is ideally placed to collect and preserve our research heritage. The National Library has the talent and technology to archive and disseminate the outputs of research from our non-university researchers (who already have access to their institutional repositories). This would provide a stable, credible, and long term solution for New Zealand researchers to comply with an OA mandate. Alternatively, these researchers could be provided with a suitable public repository such as Zenodo, a free general purpose OA repository operated by the European Organization for Nuclear Research (CERN).

If authors chose to publish their article in an OA journal they should be strongly encouraged to consult the Directory of Open Access Journals (DOAJ) to find a suitable venue for publication. The DOAJ is a community-curated list of over 16,500 OA journals. To be included, journals must make the full-text of their articles freely available without delay and with an open license attached. Journals must also be peer-reviewed, and disclose the membership of their editorial board, as well as terms around licensing, copyright, and publication fees, if they charge them. Around 70% of journals indexed in DOAJ do not charge any publication fees. If an eligible article was published in an OA journal then the final published version could be uploaded, and this would be consistent with the creative commons license attached by the author and required by the publisher.

## 7. Promote coordination with domestic and regional partners

We have a skilled community of scholarly communication professionals in our university libraries, research institutes, and non-governmental organisations. It will be essential to draw on their experience to design an effective mandate that serves all of those with a stake in Aotearoa's research. Many of these individuals and groups maintain important links with people and organisations outside of our region, and these links should be encouraged and strengthened. Many of the scholarly communication professionals and organisations that operate in this space will be able to make important contributions to realising the recommendations in this report.

CONZUL will be a crucial partner in developing an OA mandate and undertaking the associated activities to support a mandate outlined in the recommendations of this report. CONZUL cooperates closely with CAUL, the leadership body for university libraries in Australia. Membership includes 39 Australian universities and all eight university members of CONZUL. CAUL procures access to scholarly content through a consortium of Australian and New Zealand university libraries to achieve economies of scale and cost savings to its members. It also hosts communities of practise to share knowledge and foster professional development in key areas central to scholarly communication, research support, and library services. CAUL has undertaken extensive work projects on open research relevant to Australia and New Zealand. Most recently this includes work looking at Plan S, IP and copyright

REGIONAL PLATFORMS AND NETWORKS OFFER DIFFERENT WAYS TO PUBLISH PEER-REVIEWED SCHOLARLY WORKS AND ARE LIKELY TO BECOME INCREASINGLY IMPORTANT AS THE COSTS OF SUBSCRIPTION JOURNALS CONTINUE TO INCREASE

retention by research institutions, the financial impacts of APCs, and a high-level review of local repository infrastructure. CAUL and its member organisations will be critical partners in developing an effective OA mandate for New Zealand. Coordination between New Zealand and Australia on open research policy will be of benefit for both countries.

It will also be important for New Zealand to participate in conversations around regional standards and infrastructure relating to open research. For example, regional repository networks such as La Referencia (Latin America), OpenAIRE (Europe), and SHARE (United States) have delivered increased exposure and impact for research from these regions. Regional platforms and networks offer different ways to publish peer-reviewed scholarly works and are likely to become increasingly important as the costs of subscription journals continue to increase. Open Access Australasia already advocates on behalf of New Zealand and Australia in this space. Strengthening the links between Oceania and the rest of the world in developing open infrastructure will be an important priority.

## 8. Assess resourcing needs for implementation of a mandate

Surveys in Aotearoa New Zealand and overseas consistently show researchers lack a good understanding of the publishing process, the implications of different publishing choices, open research, copyright, licensing, and what they can and can't do when sharing their research. The review of local publishing (Recommendation 1) and the consultation with key stakeholders (Recommendation 8) will help to pinpoint potential areas where resourcing may need to be provided to help upskill researchers and research support staff. Research institutions, and more specifically the libraries and research services within our universities and CRIs, will likely play a crucial role in delivering training to faculty and staff. Training resources could be sourced and adapted from similar initiatives overseas, or they could be produced by a special group set up for the purpose, or by NGOs on a commissioned basis. OA Australasia has already developed a 4-week online course called OA101[138] which provides an overview of the basics of OA for professional staff at member institutions.

Longer term changes in research practices will likely require universities to make changes to the way they train and incentivise their students and staff. Many postgraduate students complete their studies without any compulsory formal training on the publishing process, and only encounter the complexities of publishing when they are ready to publish their first article. Universities could introduce a publishing skills module into their postgraduate skills programmes or inductions, and universities could look at making some of this material compulsory for masters and PhD students who are likely to publish. This material will need to be customised to account for disciplinary differences in publishing expectations and practices between different academic disciplines.

LONGER TERM CHANGES IN RESEARCH PRACTICES WILL LIKELY REQUIRE UNIVERSITIES TO MAKE CHANGES TO THE WAY THEY TRAIN AND INCENTIVISE THEIR STUDENTS AND STAFF

Non-affiliated researchers will need to be able to access training materials so they understand what is expected of them and how they can comply with the mandate, so training materials should be free and openly licensed. Funders can use their influence to encourage openness, but a broader change in research culture requires not only direction from funders, but direction from research institutions themselves. Universities need to articulate their expectations around publishing conduct, and they should consider recognising and rewarding researchers who take the time to make their research more accessible, reproducible, and rigorous.

[138] https://oaaustralasia.org/2022/05/03/oa101-member-only-4-week-online-course/

Local research institutions should take advantage of the experiences of higher education providers in the UK when implementing a potential mandate in the future. Even though the relationship between funders and institutions is different in the UK, there are still important lessons and specific actions that our institutions may find useful. For example, a report[139] commissioned by Jisc outlined some of the important lessons collected from UK institutions who have implemented processes to manage compliance with OA mandates from UK funders. These best-practise guidelines are arranged into five themes:

1. Baselining and policy compliance: Understanding the current publishing environment in the institution, consulting with institutional stakeholders, and integrating compliance with other systems.
2. Structures and workflows: Explore different ways to ensure research outputs are compliant with the mandate, design a workflow, identify who will be responsible for each step or component, and coordinate effectively across the institution.
3. Advocacy: Consulting with researchers, understanding their workflows and needs, and working to reframe barriers as positive goals. This requires the clear articulation of the benefits of OA and is supported by getting buy-in from key stakeholders and champions.
4. Cost management: Track expenditure on OA and associated compliance workflows, and make a case for a central institutional OA fund.
5. Metadata and systems interoperability: Standardise data entry in repositories and automate as many processes as possible.

Once we have a better understanding of current staffing and resource requirements in our research institutions, and a better idea about what skills our researchers need, we will be able to estimate the impact of an OA mandate on staff resourcing needs and funding. This will be determined partly by the expectations of our funders around the timing and speed of implementation.

## 9. Adopt a largely automated process to spot-check compliance

One of the most important operational issues with OA mandates identified by funders is the method of monitoring compliance. Aotearoa's major public research funders would need a cost-effective mechanism to ensure a potential OA mandate is being complied with, and to identify institutions or researchers who are lagging behind in their obligations. Fortunately, overseas experience has shown how it is possible to get high-level overviews of the publication status of in-scope articles. UK funders generally favour an approach to compliance based on publishing their expectations, supporting researchers and institutions to comply, and following up with institutions who fall below expectations. Sanctions are only ever a very rare last resort, as the compliance process is less about catching researchers and institutions out, and more about monitoring progress towards higher levels of OA.

[139] H. Blanchett and H. DeGroff, 'Moving Open Access Implementation Forward: A Handbook for Open Access Good Practice Based on Experiences of UK Higher Education Institutions' (Bristol, UK: Jisc, January 2017), https://repository.jisc.ac.uk/6565/1/JISC_OAGP_OUTPUTS_HANDBOOK_FINAL.pdf.

Compliance monitoring need not be costly or time consuming. High level compliance checking can be carried out by aggregating data from digital services such as Unpaywall and Crossref to ascertain whether or not an open version of each in-scope paper is available. A New Zealand study[140] by researchers affiliated with CONZUL has already demonstrated how custom code can be developed to harvest records from Unpaywall to show the OA status of papers published by an author affiliated with a New Zealand research institution. These records can also be broken down by funder or other metrics depending on whether the paper mentions key terms in expected parts of the article. In this way, a broad snapshot of compliance can be taken at any time.

INTERNATIONAL EXPERIENCE AND NATIONAL SURVEYS SUGGESTS THE RESEARCH COMMUNITY WILL SUPPORT A MANDATE AND WILL ENDEAVOUR TO COMPLY WITH IT'S PROVISIONS, AS LONG AS THEY ARE PROPERLY CONSULTED AND THE CHANGES ARE IMPLEMENTED THOUGHTFULLY AND CAREFULLY

CONZUL members have already committed to conducting these kinds of checks annually as part of their own work. CONZUL has offered to monitor compliance with the tools they have develop dn behalf of a central funder, for example The Royal Society Te Apārangi or directly with MBIE. Funders would then be responsible for following up with institutions or individual unaffiliated researchers. The results from compliance snapshots could be used to assess whether the mandate is working as intended or if there are any operational issues which need to be addressed. Institutions, funders, and unaffiliated authors could provide data (at minimum a list of article DOIs) to CONZUL to supplement the information they are already able to harvest automatically, and this would improve the accuracy and coverage of compliance data.

International experience and national surveys suggests the research community will support a mandate and will endeavour to comply with it's provisions, as long as they are properly consulted and the changes are implemented thoughtfully and carefully.

## 10. Stay abreast of international developments

Recent local work surveying OA practices has demonstrated that Aotearoa New Zealand is falling behind the rest of the world in making its peer-reviewed research accessible. Not only does this mean that New Zealanders and people overseas have difficulty reading (and therefore citing) New Zealand research, but it also means New Zealand could be seen to be free-riding on the efforts of other countries without contributing back. Only two out of eight New Zealand universities have OA mandates and none of our CRIs require research to be made OA. The University of Canterbury (UC) enacted a mandatory green deposit mandate in 2014 and has seen a significant increase in the proportion of eligible outputs uploaded into the institutional repository. Auckland University of Technology (AUT) enacted their mandate much more recently so are yet to formally monitor the effect on repository use. The remaining six universities all have open access policies or guidelines, but none explicitly require their staff to make their work OA.

ONLY TWO OUT OF EIGHT NEW ZEALAND UNIVERSITIES HAVE OA MANDATES AND NONE OF OUR CRIS REQUIRE RESEARCH TO BE MADE OA

The nature of research as collaborative and international means we need to ensure our domestic approaches to OA remain compatible with the strategies and policies being pursued overseas. Funders and universities in Europe and North America are much further ahead in the development of their OA policies and strategies. For example, many of the largest public research funders in the UK, US, Canada, Australia, and EU have adopted OA requirements for the work they fund (see Appendix One).

[140] White et al., 'Only Two out of Five Articles by New Zealand Researchers Are Free-to-Access'.

Virtually all of these offer green and gold routes for compliance, so that if a researcher is unable to publish in an OA journal they can upload their accepted manuscript into an institutional repository. Overseas funders are also experimenting with innovative publishing platforms such as UKRI announcing it's recent support for 'Octopus', and the open research platforms developed by the Wellcome Trust and Gates Foundation. There is a risk that Aotearoa New Zealand could fall behind and then out of step with developments happening in these regions, so we should try to foster links with public funders, NGOs, and universities overseas.

# 6 The Future of Scholarly Communications

Open Access to publicly funded research, and the related issues explored in this report, reveal important tensions within the research sector. Most of Aotearoa New Zealand's research output is publicly funded with the rationale that it is expected to deliver benefits to the whole country. But the existing subscription model of academic publishing is controlled by a few large international companies who have a legal responsibility to place the interests of their shareholders first.

### ANY DISRUPTION TO CURRENT PUBLISHING PARADIGMS AND THE RELATED ELEMENTS OF ACADEMIC CULTURE WILL BE MET WITH DENIAL, PUSH-BACK, AND RESISTANCE

Any national strategy which seeks to improve public access to publicly funded research will involve tradeoffs between the interests of publishers on one hand, and the interests of funders, institutions, and researchers on the other. There is no easy solution. Any disruption to current publishing paradigms and the related elements of academic culture will be met with denial, push-back, and resistance. But above recommendations can only ever be a starting point, and more significant changes will be needed in the long term to guarantee a more equitable arrangement. This is because when we talk about the 'access issue' (the lack of access to publicly funded research) what we're really articulating is one symptom of a wider 'ownership issue'. Who owns the dominant publishing platforms? Who owns the metrics and evaluation tools used to rank institutions and individual researchers? What are the interests and priorities of the owners of publishing platforms, journals, and metrics? Private publishing companies appear to hold most of the cards. They have been remarkably successful at enmeshing their catalogues of journals, proprietary ranking metrics, and data analytics into the bureaucracies of modern universities. Above all, they prioritise the interests of their shareholders, as they are required to do.

However, governments, funders, and researchers have a different set of interests, and they have more freedom in how they can go about achieving them. If we want to increased access to publicly funded research then we need our governments, funders, and institutions to create, invest in, run, and maintain a variety of publishing platforms. Community-owned publishing platforms make open access the default because it is the only just solution. Our research funders talk about impact, openness, and equity in their mission statements. To truly translate those aspirations into reality we will eventually need them to make some tough decisions and make some important long-term investments.

Publishers do many useful things, and perhaps the most important thing they do is coordinate the peer-review process. There's no denying they add value to the publishing process, and they should be able to make a profit. But this should be balanced with the understanding that they operate in an unusual market, and the content they sell is ultimately financed from the public purse. Publishers do not offer substitutable goods or provide much pricing transparency. The consumers of their content are insulated from their pricing structures, and their prices increase more rapidly than the rate of inflation. Unusually high profit margins have garnered a lot of attention recently, but the relentless concentration of more and more academic workflow services, proprietary metrics, and scholarly

databases into the hands of fewer and fewer companies is more concerning from a long-term perspective. These tools are used to evaluate and rank individual researchers and institutions. Aside from the obvious conflict of interest inherent in publisher services which are used to rank journals and scholarly output, these tools also present a biased picture of global research activity. The tools and products developed and sold by North American and European publishing conglomerates predictably favour the output and values of the Global North, and often exclude work published in developing countries in journals or on platforms the publishing companies choose not to recognise.[141] Publishing companies have always acted as gatekeepers to a certain extent, but more and more they are controlling the way scholarly works are produced, disseminated, evaluated, valued, and contextualised.

THE TOOLS AND PRODUCTS DEVELOPED AND SOLD BY NORTH AMERICAN AND EUROPEAN PUBLISHING CONGLOMERATES PREDICTABLY FAVOUR THE OUTPUT AND VALUES OF THE GLOBAL NORTH, AND OFTEN EXCLUDE WORK PUBLISHED IN DEVELOPING COUNTRIES IN JOURNALS OR ON PLATFORMS THE PUBLISHING COMPANIES CHOOSE NOT TO RECOGNISE

There are worrying signs that problems with the subscription model could be mirrored in the switch to a fee-based OA journal paradigm dominated by the same large publishing companies.[142] Instead of readers being excluded based on their ability to pay, authors are prevented from even publishing their work in the first place. It is well known that born-OA journals charge considerably lower publication fees than hybrid titles, and that their publication fees are much lower than current subscription models when pricing is calculated for each article.[143] But the recent announcement of astonishing publication fees by top-tier subscription journals demonstrates the unsustainability and inequities in the future of fee-based OA publishing. For example, it will cost just over NZD$16,000 to publish OA in *Nature* and just over NZD$14,000 in *Cell*. The idea that an individual researcher, their institution, or a funding agency would view such a fee as representing good value for the public is absurd. Such a figure represents over half an annual PhD scholarship at most New Zealand universities, and is many times the annual salaries of researchers in many developing countries. The radical differences between the cost of publishing an article and the prices charged by publishers have never been adequately explained, as most for-profit publishers refuse to be transparent about their costs.

THE RADICAL DIFFERENCES BETWEEN THE COST OF PUBLISHING AN ARTICLE AND THE PRICES CHARGED BY PUBLISHERS HAVE NEVER BEEN ADEQUATELY EXPLAINED, AS MOST FOR-PROFIT PUBLISHERS REFUSE TO BE TRANSPARENT ABOUT THEIR COSTS

While transformative agreements have the potential to increase the proportion of OA output for the institutions and publishers which adopt them, they are usually predicated on the idea that institutions maintain their current spending levels with regular price increases built in to benefit the publisher.[144] They are only an option for wealthy institutions, and even then, they can represent an enormous administrative burden in maintaining separate agreements with many different publishers, each with

[141] Tennant et al., 'Ten Hot Topics around Scholarly Publishing'.
[142] N. L. Cole, S. Reichmann, and T. Ross-Hellauer, 'Global Thinking. ON-MERRIT Recommendations for Maximising Equity in Open and Responsible Research' (Zenodo, 14 March 2022), https://doi.org/10.5281/zenodo.6276753.
[143] A. Grossmann and B. Brembs, 'Current Market Rates for Scholarly Publishing Services', *F1000Research* 10 (1 July 2021): 20, https://doi.org/10.12688/f1000research.27468.2.
[144] A. Farley et al., 'Transformative Agreements: Six Myths, Busted', *College & Research Libraries News* 82, no. 7 (2021), https://doi.org/10.5860/crln.82.7.298.

their own terms. Even if there was enough money in the system to transition to OA through the widespread adoption of fee-based OA journals and transformative agreements, [145] the long-term financial sustainability of such a strategy is doubtful. These kinds of deals also remove the only potential benefit that comes with an author-pays system: when authors are required to pay they have an incentive to shop around and make publishing decisions based on price, which may eventually lead to greater competition between journals based on price. But when the institution steps in and pays for publishing through a transformative agreement it removes any incentives authors may have to be sensitive to publishing prices.

MANDATING OA WILL NOT SOLVE ALL THE DEEP INEQUITIES INSIDE THE ACADEMY, BUT IT IS CERTAINLY AN IMPORTANT STEP IN IMPROVING THE RESEARCH PROCESS AND DEMOCRATISING PUBLICLY-FUNDED KNOWLEDGE

Changing one part of the research sector is unlikely to lead to significant change because of the way research is funded, conducted, disseminated, and valued. Mandating OA will not solve all the deep inequities inside the academy, but it is certainly an important step in improving the research process and democratising publicly-funded knowledge. Of course, there are other important barriers which need to be considered in parallel. New publishing practices, for example, will only be welcomed and taken up to the extent that they allow researchers to continue their participation in academic cultures of prestige. The way that researchers are evaluated by institutions and funders determines how willing they are to engage with the spirit of an OA mandate. This is why OA mandates need to be coupled with broader actions which signal to researchers that their work will be judged on its own merits, and not on shallow metrics or brand recognition in an "impressive" journal.[146]

Funders and institutions have a lot of power to influence the way that research is conducted and communicated. Some institutions have recognised that relying on misused metrics such as JIFs leads to perverse outcomes. The University of Utrecht in the Netherlands has formally abandoned using JIFs in hiring and promotion decisions, instead introducing a new evaluation policy which will judge academics by their commitment to teamwork, open research, and outreach activities.[147] Moves like this synergise with an OA mandate by demonstrating how open research practices will no longer go unnoticed. Disrupting entrenched prestige-economies which reward a small elite of senior faculty while locking out those who simply don't have the right connections will inevitably help to diversify the academy.

The long-term sustainability of academic publishing requires us to go back to basics and ask what publishing is for and who it serves. Publication is used to separate validated knowledge claims from those which are yet to undergo formal scrutiny. Peer-review is an imperfect process subject to human biases and manipulation, but it provides a basic set of checks and balances to audit scholarly works.[148] For peer-review and publication to be trusted by the scholarly (and wider) community there needs to be as much transparency as possible in these processes. If researchers, institutions and funders

[145] J. W. Houghton and C. Oppenheim, 'The Economic Implications of Alternative Publishing Models', *Prometheus* 28, no. 1 (1 March 2010): 41–54, https://doi.org/10.1080/08109021003676359.
[146] A. Fyfe et al., 'Untangling Academic Publishing: A History Ofthe Relationship between Commercial Interests, Academic Prestige and Thecirculation of Research' (Birbeck University of London, May 2017), https://doi.org/10.5281/zenodo.546100.
[147] C. Woolston, 'Impact Factor Abandoned by Dutch University in Hiring and Promotion Decisions', *Nature* 595, no. 7867 (25 June 2021): 462–462, https://doi.org/10.1038/d41586-021-01759-5.
[148] J. P. Tennant et al., 'A Multi-Disciplinary Perspective on Emergent and Future Innovations in Peer Review', *F1000Research* 6 (29 November 2017): 1151, https://doi.org/10.12688/f1000research.12037.3.

wanted to redesign academic publishing to serve the interests of scholarship and the dissemination of knowledge how many parts of the current system would remain? Finding economic structures to support academic publishing is different to ensuring commercial publishers can maintain current profit margins. As the International Science Council concluded in their recent report, the academic publishing system should adapt to the new opportunities afforded by advances in technology rather than embedding inflexible infrastructures designed to meet the needs of a print paradigm.

## THE CURRENT SYSTEM ENCOURAGES RESEARCHERS TO SHOP FOR JOURNALS WITH THE HIGHEST 'PRESTIGE'

The current system encourages researchers to shop for journals with the highest 'prestige'. Instead of researchers asking "whats the 'best' journal I can get this published in?", beginning a long wasteful review cascade from high IF journals down to the one which eventually accepts their work, they should be incentivised to publish their work on open platforms and ask "what metadata, identifiers, and tags should I add to this work so this research can be found by the people who need to read it?".

Publishers aim to control access to what they call the 'version of record', in most cases a static pdf file hosted on their websites. Surely an open 'record of versions'[149] is far more valuable because it shows how ideas and methods have evolved over time and have been refined in response to review.[150] A 'fixed' version of record is an artifact of print publishing and fails to harness the power of digital technologies or respect the complexity of modern workflows. Scholarly articles could be reimagined as 'living documents'[151] which act as a single point for reporting everything associated with a discrete research project. As each component of the research process is added, the document would evolve through a series of versions, and these versions could be tracked and annotated in a similar way to how version control is used to track and collaborate on software code. The scholarly works of the future will surely be web-based, enriched with a variety of metadata, embedded with interactive visualisations, and linked to a network of associated outputs and information.[152] It is becoming clearer that non-profit or community-owned platforms offer significant advantages over current publishing models due to their ability to focus more on what is good for research, rather than what is good for the shareholder.[153]

Large research funders have recognised the flaws in the current subscription or APC-based OA publishing models and are seeking to disrupt these paradigms with their own publishing options. They favour creating their own platforms, rather than journals, so that authors funded by their grants can publish their work OA, for free, while maintaining the standards of peer-review. The Wellcome Trust was the first funder to launch a publishing platform in 2016 with Wellcome Open Research.[154] Wellcome-funded authors who submit a manuscript to the platform have their work published immediately after some pre-screening checks. Reviewers are then invited to review the manuscript

[149] This term was coined by Jeroen Bosman and Bianca Kramer in 2016.
[150] J.-C. Guédon, 'Guest Post by Jean-Claude Guédon: Scholarly Communication and Scholarly Publishing', *Open Access Publishers Association* (blog), 21 April 2021, https://oaspa.org/guest-post-by-jean-claude-guedon-scholarly-communication-and-scholarly-publishing/.
[151] D. R. Shanahan, 'A Living Document: Reincarnating the Research Article', *Trials* 16, no. 1 (11 April 2015): 151, https://doi.org/10.1186/s13063-015-0666-5.
[152] Tennant et al., 'A Multi-Disciplinary Perspective on Emergent and Future Innovations in Peer Review'.
[153] For example the development of 'Octopus': https://www.ukri.org/news/funding-agreed-for-a-platform-that-will-change-research-culture/
[154] Wellcome Trust, 'About Wellcome Open Research', accessed 2 April 2022, https://wellcomeopenresearch.org/about.

and these reports are published openly alongside the manuscript, with the authors' responses. Revised versions of the article are published and separately citable, and authors are encouraged to publish their datasets on the same platform. The Bill & Melinda Gates Foundation launched a similar initiative called Gates Open Research in 2017.

More recently, UKRI provided a grant of £650,000 for the development of Octopus, a global open publishing platform founded by Dr Alexandra Freeman, Executive Director of the Winton Centre for Risk and Evidence Communication at Cambridge University.[155] Octopus presents a new vision for publishing where the elements of a traditional article (problem, hypothesis, methods, results, analysis, interpretation) can be published separately and linked together with data, peer review reports, real-world implementation, or other downstream outputs. Credit can be attributed at each stage, and researchers can collaborate to build chains of work. It will be free for any researcher to publish their work on Octopus and the platform will be completely OA. These kinds of initiatives will at the very least inject some much-needed innovation and new ideas into the centuries-old practise of scholarly publishing.

Ultimately governments and funders are in a strong position to shape the kind of publishing system they would like to see. If they choose to recognise the benefits of alternative publishing models, and more importantly to invest in them, they will help to secure a more equitable future for academic publishing. For-profit publishers can and should be part of a diverse and healthy publishing environment. But their interests often diverge from funders and researchers, so it will be important to strive towards a sensible balance between those who publish research, and those who actually fund it and conduct it.

ULTIMATELY GOVERNMENTS AND FUNDERS ARE IN A STRONG POSITION TO SHAPE THE KIND OF PUBLISHING SYSTEM THEY WOULD LIKE TO SEE

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[155] 'Funding Agreed for a Platform That Will Change Research Culture', UK Research & Innovation, 6 August 2021, https://www.ukri.org/news/funding-agreed-for-a-platform-that-will-change-research-culture/.

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# Appendices

## Appendix One: International OA mandates (Green OA pathway terms)

| Jurisdiction | Funder | Annual disbursements (NZ$m) | Enacted | Article version | Repository | Embargo period | Licenses | Link |
|---|---|---|---|---|---|---|---|---|
| New Zealand | Marsden Council | 54 | No policy | | | | | Link |
| | Health Research Council | 77 | No policy | | | | | |
| | MBIE Contestable Fund | 190 | No policy | | | | | |
| | TEC PBRF | 300 | No policy | | | | | |
| | CoREs | 51 | No policy | | | | | |
| | National Science Challenges | 132 | No policy | | | | | |
| Australia | Australian Research Council | 900 | 2013 | AAM | Subject/institutional repositories<br>Public digital archives | 12 mths | CC BY suggested | Link |
| | National Health & Medical Research Council | 955 | 2012 | AAM | Subject repositories<br>Institutional repositories | 12 mths | CC BY suggested | Link |
| Austria | Austrian Science Fund | 450 | 2020 | AAM | Europe PubMed Central | 12 mths | CC BY | Link |
| Belgium | Belgian Science Policy Office | – | 2017 | AAM | BELSPO repository | 6 mths<br>12 mths (HSS) | CC BY | Link |
| Canada | National Research Council Canada | 1,120 | 2009 | AAM | NRC Publications Archive | As per publishers requirements | As per publishers requirements | Link |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Canadian Institutes of Health Research | 1,120 | 2008 | AAM | Any appropriate repository | 12 mths | Author encouraged to retain rights | Link |
| | Natural Sciences & Engineering Research Council of Canada | 1,140 | 2015 | AAM | Subject repositories<br>Institutional repositories | 12 mths | Unspecified | Link |
| China | Chinese Academy of Sciences | | 2014 | AAM | Any appropriate repository | 12 mths | Unspecified | Link |
| | National Natural Science Foundation of China | 2,115 | 2014 | AAM | NSFC Repository | 12 mths | Unspecified | Link |
| Denmark | Danish Public Research Councils | – | 2012 | AAM | Subject repositories<br>Institutional repositories | 6 months<br>12 months (HSS) | Unspecified | Link |
| European Union | European Research Council | 4,510 | 2013 | Unspecified | Subject repositories<br>Institutional repositories | 6 mths<br>12 mths (HSS) | Unspecified | Link |
| | European Commission Horizon 2020 | ? | 2016 | AAM | Subject repositories<br>Institutional repositories | 6 mths<br>12 mths (HSS) | CC license suggested | Link |
| Finland | Academy of Finland* | 845 | ? | AAM | Any appropriate repository | 6 mths<br>12 mths (HSS) | CC BY | Link |
| France | Agence Nationale de la Recherche* | 1,175 | 2013 | Full text | HAL<br>Local repository | None permitted | CC BY suggested | Link |
| Hungary | Magyar Tudományos Akadémia | ? | 2013 | AAM | REAL | 12 mths<br>24 mths (HSS) | As per publishers requirements | Link |
| India | Indian Council of Agricultural Research | 1,410 | 2013 | AAM | Any appropriate repository | 12 mths | Unspecified | Link |
| Ireland | Irish Research Council | 170 | 2013 | AAM | Institutional repository | 6 mths<br>24 mths (HSS) | As per publishers requirements | Link |
| | Science Foundation Ireland* | 350 | 2020 | AAM | Europe PubMed Central | None permitted | CC BY suggested | Link |
| Italy | Istituto Superiore di Sanità | ? | ? | AAM | DSpaceISS | 24 mths | As per publishers requirements | Link |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Israel | No policy information found | | | | | | | |
| Japan | Japan Ministry of Science & Technology | 1,410 | 2013 | AAM | Subject repositories<br>Institutional repositories | As per journal policy | Unspecified | Link |
| Luxembourg | Fonds National de la Recherche Luxembourg* | 170 | 2017 | AAM | Any appropriate repository | None permitted | CC BY | Link |
| Norway | Norwegian Ministry of Education & Research | ? | 2017 | Unspecified | Institutional repositories | Unspecified | Unspecified | Link |
| Portugal | Fundação para a Ciência e a Tecnologia* | ? | 2014 | AAM | RCAAP | 6 mths<br>12 mths (HSS) | As per publishers requirements | Link |
| Russia | No policy information found | | | | | | | |
| Serbia | Ministry of Education, Science and Technological Development | ? | 2018 | AAM | Any appropriate repository | 12 months<br>18 months (HSS) | As per publishers requirements | Link |
| Slovenia | Republic of Slovenia | 1,410 | 2015 | AAM | Subject repositories<br>Institutional repositories | 6 mths<br>12 mths (HSS) | CC license suggested | Link |
| South Africa | National Research Foundation of South Africa | ? | 2015 | AAM | Institutional repositories | 12 mths | Unspecified | Link |
| Switzerland | Swiss National Science Foundation | 1,535 | 2018 | AAM | Subject repositories<br>Institutional repositories | 6 mths (articles)<br>12 mths (other) | Unspecified | Link |
| United Kingdom | UK Research & Innovation* | 11,800 | 2021 | AAM | Various | None permitted | CC BY | Link |
| | Research Excellence Framework | 3,950 | 2016 | AAM | Institutional or subject repository<br>Preprint server | 12-24 mths | CC BY-NC-ND suggested | Link |
| | National Institutes of Health Research | 495 | 2019 | AAM | Europe PubMed Central | 6 mths | CC BY | Link |
| United States | National Institutes of Health | 5,920 | 2008 | AAM | PubMed Central | 12 mths | Unspecified | Link |

| NGO Jurisdiction | Funder | Annual (NZ$m) | Enacted | Article version | Repository | Embargo period | Licenses | Link |
|---|---|---|---|---|---|---|---|---|
| New Zealand | New Zealand Lottery Grants Board, Health Research Committee | 4.2 | No policy | | | | | Link |
| United Kingdom | Blood Cancer UK | 9 | 2014 | AAM | Europe PubMed Central | 6 mths | CC BY suggested | Link |
| | British Heart Foundation | 185 | 2007 | AAM | Europe PubMed Central | 6 mths | Unspecified | Link |
| | Cancer Research UK | 915 | 2007 | AAM | Europe PubMed Central | 6 mths | CC BY suggested | Link |
| | Motor Neurone Disease Association | 9 | 2011 | AAM | Europe PubMed Central | 6 mths | Unspecified | Link |
| | Multiple Sclerosis Society UK | 10 | 2014 | AAM | Europe PubMed Central | 6 mths | Unspecified | Link |
| | Parkinson's UK | 75 | 2014 | AAM | Europe PubMed Central | 6 mths | CC BY suggested | Link |
| | Versus Arthritis UK | ? | 2014 | AAM | Europe PubMed Central | 6 mths | Unspecified | Link |
| | Wellcome Trust* | 1,975 | 2005 | AAM | Europe PubMed Central | 6 mths | CC BY | Link |
| United States | Bill & Melinda Gates Foundation* | 7,050 | 2015 | AAM | Europe PubMed Central | None | CC BY | Link |
| | Howard Hughes Medical institute* | 1,165 | 2020 | AAM | Unspecified | None | CC BY | Link |

## Appendix Two: Important operational considerations

Dealing with copyright, licensing, embargoes, and the selection of appropriate journals and repositories can often be the most complex and confusing parts of OA mandates. Regardless of the strategy chosen or direction of OA in Aotearoa, researchers should be encouraged to consider these concepts when publishing their work.

**Suitable journals and repositories**

If authors choose to publish their article in an OA journal they should be strongly encouraged to consult the Directory of Open Access Journals (DOAJ) to find a suitable venue for publication. The DOAJ is a community-curated list of over 16,500 OA journals. To be included, journals must make the full-text of their articles freely available without delay and with an open license attached. Journals must also be peer-reviewed, and disclose the membership of their editorial board, as well as terms around licensing, copyright, and publication fees, if they charge them. Around 70% of journals indexed in DOAJ do not charge any publication fees (but funder/institutional incentives mean most researchers will want to publish in a fee-based OA journal as these tend to have higher impact factors).

If authors instead choose to publish in a toll-access journal (subscription journal; paywalled access), at the very minimum they should be required to deposit their Accepted Manuscript in an OA repository. In the first instance, they should use their institutional repository (if they are affiliated with a New Zealand university). Ideally, non-university researchers could deposit their AMs into a repository built and maintained by The National Library of New Zealand | Te Puna Mātauranga o Aotearoa.

The National Library is trusted to collect, preserve, and protect Aotearoa's documentary heritage, including digital documents. It collaborates with a wide variety of other institutions and individuals who share similar purposes, and as New Zealand's legal deposit library, it is ideally placed to collect and preserve our research heritage. The National Library has the talent and technology to archive and disseminate the outputs of research from our non-university researchers (who already have access to their institutional repositories). This could include CRIs, independent research organisations, and independent researchers who receive public funding. This would provide a stable, reliable, and credible platform for New Zealand researchers to share their work.

Otherwise, they could use a public repository such as one of the following:

- arXiv: Hosted by Cornell University. Physics, mathematics, non-linear science, computer science, quantitative biology, quantitative finance and statistics.
- OSF Preprints: Hosts a variety of specialised subject repositories similar to arXiv.
- PeerJ Preprints: Hosted by PeerJ. General purpose.
- Zenodo: Hosted by CERN. General purpose.

**Criteria for Green OA exceptions**

There may be cases where it is not possible for a researcher or institution to make a copy of the AM available in a repository. In such cases, the researcher or institution should be required to keep a record of the bibliographic details of their article (authors, date published, journal, DOI) along with the reason they were unable to comply. Examples of reasonable exceptions are listed below:

*1. Deposit exception*

- It was not possible to secure the use of a suitable repository.
- It was not possible to obtain the Accepted Manuscript (e.g. from the corresponding author) due to retirement, illness, or death.
- It was not possible to obtain the Accepted Manuscript from the publisher.
- Depositing the output would present a security risk.

*2. Access exception*

- The output depends on the reproduction of third-party content for which open access rights could not be obtained.
- The venue of publication requires an embargo longer than what is acceptable and was the most appropriate venue for publication.
- The venue of publication does not allow the uploading of the Accepted Manuscript into a repository and was the most appropriate venue for publication.

*3. Technical exception*

- At the time of deposit, the repository experienced a technical issue which made it impossible to upload the output and this issue has not yet been rectified.

*4. Other exception*

- Circumstances beyond the control of the researcher or their institution made it impossible to comply with the mandate, including extenuating personal circumstances of the author (such as periods of extended leave), industrial action, closure days, or software problems beyond those listed in the technical exceptions.

**Copyright, licensing, and embargoes**

Copyright, licensing, and embargoes are often the most controversial elements of OA mandates. Copyright is the right to control the copying of one's work and is granted immediately on the creation of a work.[156] It is an internationally recognised legal protection which gives the copyright holder the right to copy, distribute, modify, show, or communicate an original work, and to give permission for someone else to do the same. The relationship between the copyright holder, the work, and permissions for reuse are set out in a copyright license. A person may not lawfully perform any of the above activities with a copyrighted work unless the license explicitly allows it. The only exceptions to this are called "fair dealing" in New Zealand (and other names such as "fair use" in the United States), where a person may use a work for the purposes of criticism, review, reporting, research, or private study without obtaining permission from the copyright holder.

Most OA journals allow authors to retain copyright in their article, and only require a non-exclusive license to publish and market the work. The final published work is made immediately OA and an open license is attached to it. Open licenses such as the Creative Commons framework, or institutional scholarly licenses, allow a wide range of reuse activity without the user needing to ask permission. On the other hand, for-profit publishers typically require copyright to be transferred from the author or institution to them as a condition of publishing a manuscript. Sometimes they license back a bundle

[156] https://digitalnz.org/make-it-digital/enabling-use-re-use

of rights to the author or institution, but in most cases, copyright transfer means authors and institutions are not permitted to share their work as widely as they would like (or as widely as they think they can). All major publishers explicitly allow the uploading of the Accepted Manuscript to a repository, but they typically impose an embargo period preventing access to the AM for a certain period of time from when the article is published in a toll access (subscription) journal. Most of the journals which New Zealand authors choose to publish in require 6-12 month embargoes,[157] and a smaller proportion require longer than 12 months. About 3,000 journals allow zero-embargo access to the AM with a liberal open license[158] but these represent a small fraction of total numbers of subscription journals.

An OA mandate needs to be clear about whether the author should retain copyright in their article, whether a specific license is required to be attached to a certain version of the article, and whether or not publisher-imposed embargoes are to be respected, and if so, the maximum acceptable length of any embargoes. For example, Plan S overrides publisher policies in several ways:

- By requiring the author to retain copyright in their article
- By requiring an open license to be attached to AMs in repositories
- By requiring AMs to be made available without any embargo periods

Only one small society publisher has formally refused to accept submissions from authors funded by cOAlition S, while most large publishers are announcing updates to their policies to accommodate these terms. The update to UKRI's OA policy in August 2021 prompted a statement from Taylor & Francis who declared they would not support the policy.[159] The extent to which this is a firm policy, or part of a future negotiation strategy, remains to be seen.

Creative Commons (CC) licenses are frequently a requirement for ensuring the reuse terms of AMs comply with mandates overseas, as they provide a relatively simple human-readable summary of the terms of reuse and are generally understood by publishers. Most funders require a CC BY license (Creative Commons Attribution License) which means the work can be used for any purpose, including commercial exploitation, provided the copyright holder is acknowledged. The recently updated UKRI policy allows an Open Government License to be used when the work is subject to Crown Copyright, and like Plan S, allows the work to be licensed under a CC BY-ND license (Creative Commons Attribution No-Derivatives) if justified by the researcher. A no derivatives license means the work cannot be distributed if it is changed or built upon. If there is a licensing requirement, the author is usually required to instruct the publisher of the licensing requirement at the point of submission. This usually occurs by attaching a prepared statement supplied by the mandating agency. For example, UKRI requires authors to add the following text to their submissions in the acknowledgements section:

"For the purpose of open access, the author has applied a Creative Commons Attribution (CC BY) licence (where permitted by UKRI, 'Open Government Licence' or 'Creative Commons Attribution No-

[157] White et al., 'Only Two out of Five Articles by New Zealand Researchers Are Free-to-Access'.
[158] J. Bosman and B. Kramer, 'Green OA: Publishers and Journals Allowing Zero Embargo and CC-BY', *Innovations in Scholarly Communication* (blog), 16 July 2020, https://101innovations.wordpress.com/2020/07/16/green-oa-publishers-and-journals-allowing-zero-embargo-and-cc-by/.
[159] https://newsroom.taylorandfrancisgroup.com/taylor-francis-response-to-the-ukri-policy-announcement/

derivatives (CC BY-ND) licence may be stated instead) to any Author Accepted Manuscript version arising."

This is functionally similar to the Plan S Rights Retention Strategy[160] where authors retain copyright in the AM by including a statement from their funder as part of the submission process. For example, the relevant text for Wellcome grantees:

"This research was funded in whole or in part by the Wellcome Trust [Grant number]. For the purpose of Open Access, the author has applied a CC BY public copyright licence to any Author Accepted Manuscript (AAM) version arising from this submission."

According to the coalition, this text takes legal precedence over any downstream agreement between author and publisher and has the effect of allowing the author to retain certain copyrights in the work. It is unclear how publishers would respond to a New Zealand OA mandate which overruled their terms.

[160] https://www.coalition-s.org/rights-retention-strategy/

## Appendix Three: Decision Tree for OA Publishing